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ANNUAL REPORT

Bureau of Public Roads

FISCAL YEAR 1951

Approach to Pacheco Pass in California. The narrow, winding, old route is indicated by a black line.

DEPARTMENT OF COMMERCE

U. S. SUPERINTENDENT OF DOCUMENTS

JAN 25 1952

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DEPARTMENT OF COMMERCE UNITED STATES OF AMERICA

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ANNUAL REPORT OF THE BUREAU OF PUBLIC ROADS

Factors Affecting Progress

THE NEED and demand for highway improvement was never greater than in the fiscal year 1951.[1] Both popular demand for elimination of congestion, delays, and hazards to travel and scientific studies of traffic and highway conditions indicated the great need for improvement. A volume of traffic far beyond that for which the greater portion of the existing highway system was planned was operating under adverse conditions and at excessive cost.

Motor-vehicle registrations increased to over 49 million in the calendar year 1950—about double the number in 1934. Traffic has increased at an average rate of about 4 percent per year for 15 years. Such a rate of increase, if continued, will double the present volume of traffic in 18 years, or by 1969. We are being overwhelmed by a flood of traffic. Mileage of highway travel reached 458 billion in the calendar year 1950. From 1947 to 1950 there was an increase in travel of 87 billion vehicle-miles—an amount equal to all highway travel in 1923.

The big jump in national production, resulting from steps taken to meet the national emergency, caused a striking increase in the movement of freight by truck. Ton-miles of freight carried by highway amounted to 107 billion in the calendar year 1949, rose one-third to 142 billion in 1950, and is still climbing in 1951. The increase in 1950 is more than the total freight transported in 1936. At the present rate of increase our highways will soon be carrying three times the freight carried during the World War II years.

Highway organizations at all levels of government put forth their maximum efforts to provide better travel conditions, but funds available permitted only a slight increase in accomplishment over the preceding fiscal year. In the fiscal year 1951, highway contract awards by State highway departments amounted to $1.43 billion as compared to $1.40 billion in 1950 (fig. 1). Corresponding mileages were 52,189 in 1951 and 54,114 in 1950. In the last 3 months of the fiscal year 1951 awards dropped somewhat below the level of the same period of 1950.

The decline in highway construction bid prices, which began in the middle of 1949 (fiscal year), continued throughout 1950. The beginning of the fiscal year 1951 witnessed the outbreak of hostilities in Korea, and from that time until the end of the year there was a rise of 15.6 percent in highway construction bid prices. Notwithstanding this comparatively high rate of increase, the bid prices at the end of the fiscal year were still 2.1 percent below the postwar peak, which occurred in the second quarter of the fiscal year 1949.

During the fiscal year 1951 highway construction labor and material costs increased approximately 7 percent and 8 percent respectively. These figures are below those for commodity prices and more general construction cost indexes.

Throughout the year the uncertain world situation and preparations for an armament program, with impending danger of shortages of materials and labor, cast a shadow over the highway program. It caused highway officials to intensify

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[1] The fiscal year extended from July 1, 1950, to June 30, 1951.

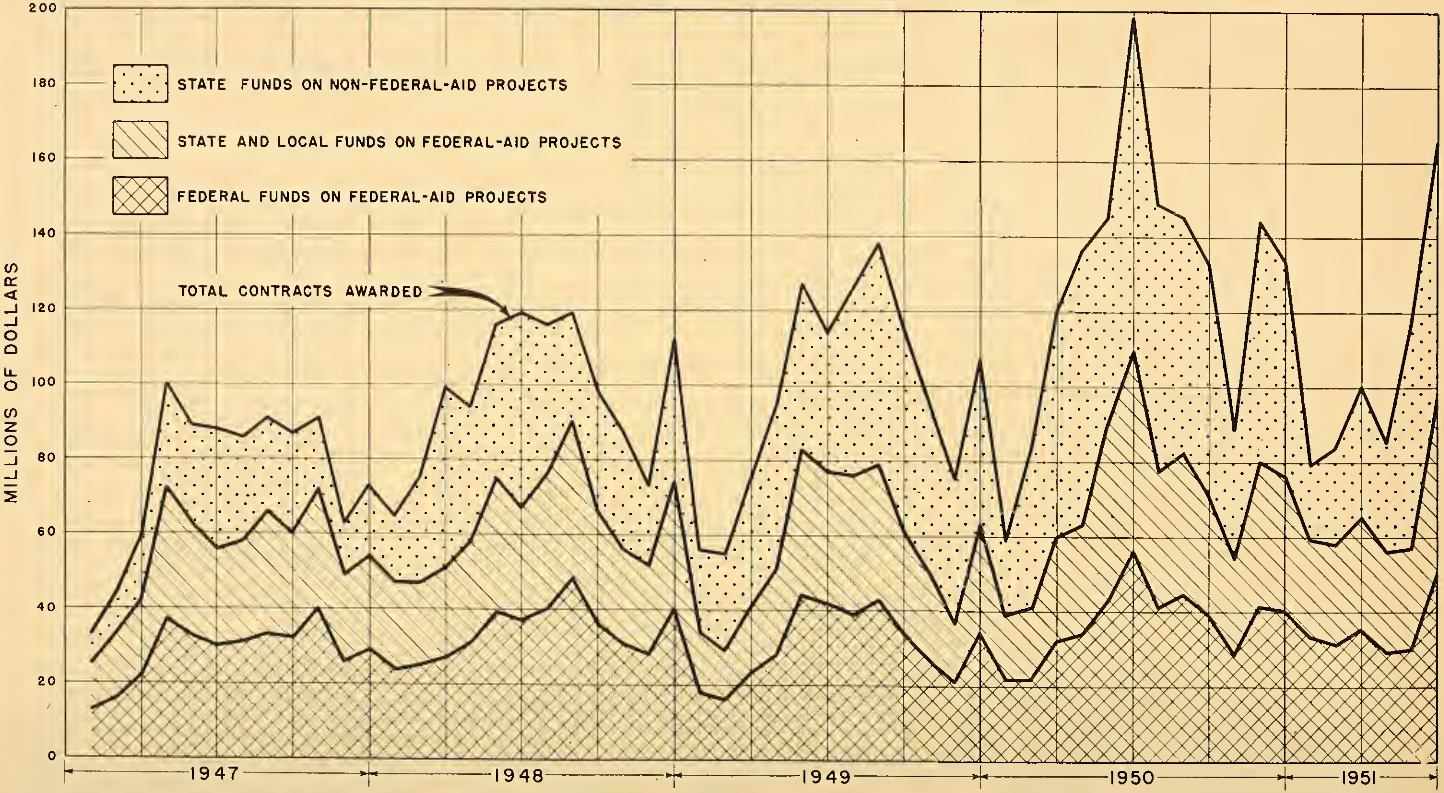


Figure 1.—Highway construction contracts awarded by State highway departments.

rather than relax their efforts to improve the main highways. Highway transport increases in direct proportion to industrial activity, whether it be for peace or for war, and it was realized that the strain to be placed on main highways would be greater than ever before. There was serious alarm over what would happen should restrictions make it necessary to decrease the rate of replacement and reconditioning of old and worn-out highway surfaces and bridges.

As anticipated, the national emergency resulted in serious shortages of steel and other materials and equipment vital to highway construction and maintenance work. A system of controls was established under the direction of the Office of Defense Mobilization, the Defense Production Administration, and the National Production Authority to make certain that the requirements for national defense, defense-supporting industries, and essential civilian activities would be given preference in procurement and use of the scarce materials and equipment.

The Bureau was designated as claimant agency for all highway work in the country regardless of how financed and regardless of whether it was under the supervision of the Federal, State, or local governments or special commissions. In this capacity, and with the assistance of a special committee established by the American Association of State Highway Officials, data were assembled from all highway construction and maintenance agencies on the estimated requirements of scarce materials and equipment for each quarter of the 1951 and 1952 calendar years. These estimates were submitted to the Defense Production Administration as a basis for determining allotments of materials and equipment for highway purposes.

During February and March of 1951 priority ratings for steel and other materials and equipment for highway projects were issued by the National Production Authority on a spot assistance basis. On March 28 the Bureau was given an allotment of 151,000 tons of steel for May and a like allotment for June, against which priority ratings could be issued. Allotments of 300,000 tons of steel and 750,000 pounds of copper were made available on May 14 for the third quarter of 1951.

The National Production Authority issued an order on May 3 requiring approval of that agency before construction could commence on any project requiring the use of more than 25 tons of steel. On June 7 this authority to authorize commencement of construction on highway projects was delegated to the Secretary of Commerce and immediately redelegated to the Commissioner of Public Roads.

The Federal-Aid Program

The Federal-State cooperative highway construction program was financed from Federal-aid funds of $450 million authorized for the fiscal year, and from remaining balances of prior authorizations, together with State matching funds. All classes of Federal-aid projects brought to completion during the year had a total length of 20,030 miles. This is 5 percent less than the total mileage completed during the previous year.

Pursuant to the President's request of July 21, 1950, that all programs be reexamined with the object of giving first priority to those which contribute directly to the national defense or to essential civilian requirements, all new projects have been carefully screened and only those meeting essentiality criteria have been approved for construction.

During the year improvements were completed as follows: On the Federal-aid system outside of cities (principal intercity highways), 4,850 miles of highways and 849 bridges; on urban portions of the Federal-aid highway system, 554 miles of streets and 294 bridges; and on secondary or farm-to-market roads, 13,875 miles of roads and 1,556 bridges. Continuation of the long-term program of eliminating hazards to life at railway-highway grade crossings brought the following accomplishments for the year: 125 crossings eliminated, 48 inadequate grade-separation structures reconstructed, and 357 crossings protected by flashing-light signals or other appropriate safety devices.

The reexamination of the program to give priority to defense requirements, coupled with growing scarcity of steel and other critical materials, have tended to slow the program to some extent. Contracts were awarded during the year for improvements to 19,827 miles of highways and streets. Work put in place amounted to 95 percent of the $450 million authorization for the year. Construction was in progress or scheduled to start soon on 22,571 miles of highways and streets, at the year's end. Projects for the construction of 21,517 miles were programed during the year, and a majority of States were assigning to projects funds apportioned for the fiscal year 1952. Tables in the appendix furnish details of the program accomplishments during the year and the status of the program at the year's end.

Classes of Federal-Aid Work

Continuation of Federal assistance to the States for the improvement of three general classes of highways during the fiscal years 1952 and 1953 was provided by the Federal-aid Highway Act of 1950, approved September 7, 1950. This act authorized $500 million for each of the two fiscal years.

The Federal-aid highway system.—Improvement of principal highways included in the Federal-aid highway system has been continuous since the Federal Highway Act provided for designation of the system in 1921. Forty-five percent of Federal-aid funds authorized since World War II have been made available for rural and urban improvements on the Federal-aid highway system. Primary funds in the amount of $202.5 million were authorized for each of the fiscal years 1950 and 1951. The authorization for each of the fiscal years 1952 and 1953 amounts to $225 million. During the year about one-third of primary funds allotted to approved projects were for improvements to the National System of Interstate Highways.

The Federal-aid secondary system.—The Federal Government's interest in secondary or farm-to-market roads is expressed by the provision of 30 percent of the total Federal-aid fund authorization for this class of road improvement. For each of the fiscal years 1950 and 1951 secondary fund authorizations have been $135 million; for each of the fiscal years 1952 and 1953 the secondary fund authorizations have been increased to $150 million.

The Federal-aid urban system.—Funds for assisting in the construction of the modern highway arteries needed to expedite traffic movement in cities comprise the remaining 25 percent of Federal-aid authorizations. Urban funds of $112.5 million were authorized for the fiscal years 1950 and 1951; for the fiscal years 1952 and 1953 the urban fund authorizations are at the annual rate of $125 million. Primary funds are also available for expenditure on improvements to the urban system, which comprises the urban portion of the Federal-aid highway system.

Status of Work at End of Fiscal Year

Figure 2 shows the status of the Federal-aid program financed from funds currently available. As the fiscal year ended, plans had been approved or work was under way on improvements to 21,523 miles of highways and streets in the Federal-State cooperative program. These improvements had a total estimated cost of $1.54 billion, of which $774 million were Federal funds. This

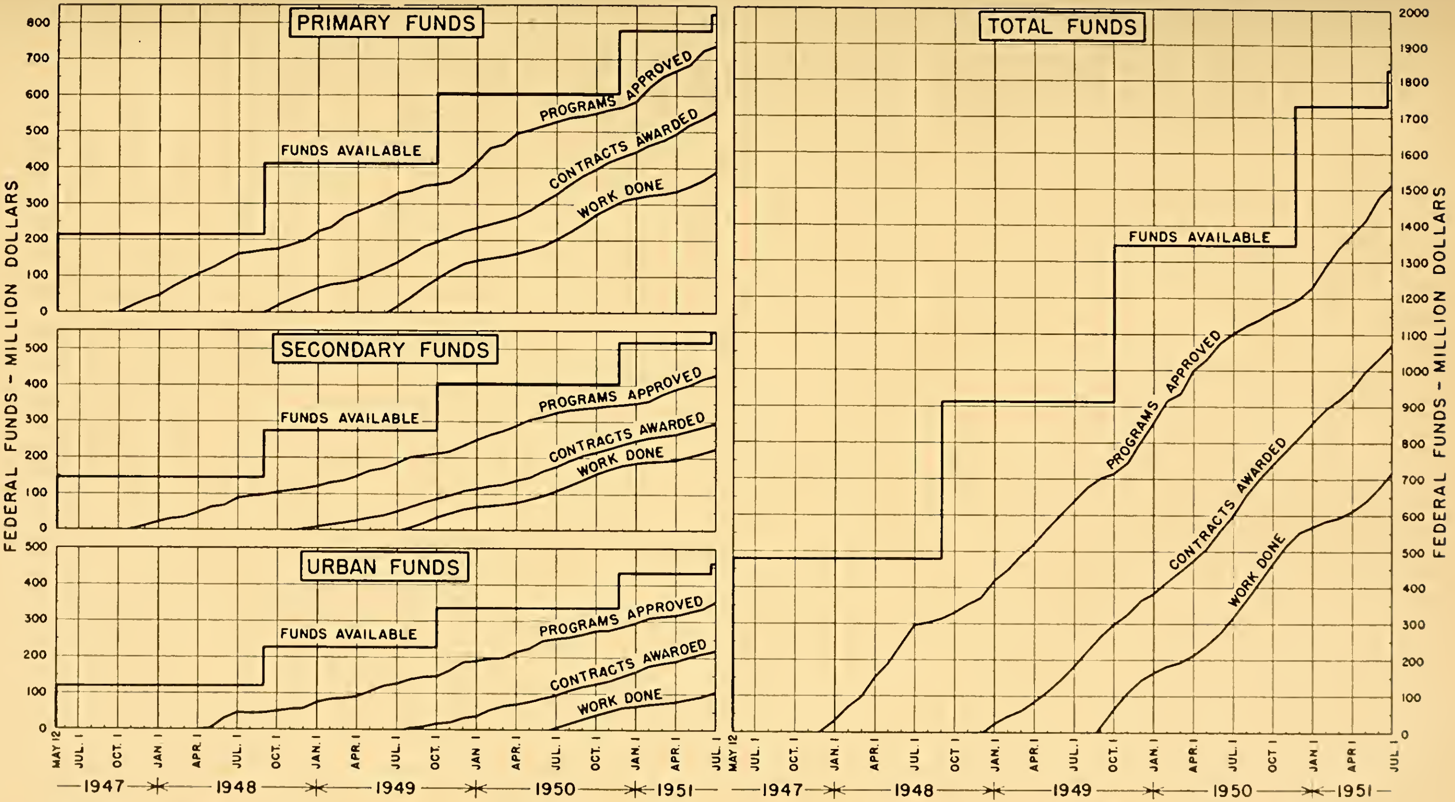


Figure 2.—Progress in approving programs, awarding contracts, and constructing projects with available Federal-aid funds.

work included the elimination of 249 railway-highway grade crossings, the reconstruction of 47 obsolete grade-separation structures, and the installation of flashing lights or other suitable protective devices at 332 railroad grade crossings. An additional 1,048 miles, costing a total of $49 million, including $41 million of Federal funds, were included in the National forest, National park, public land, and flood-relief programs.

The National System of Interstate Highways

Improvement of the National System of Interstate Highways continued to rank as of first importance with highway officials and with highway users. Designated in 1947 as a result of Federal legislation in 1944, and limited in extent by law to 40,000 miles, this system is comprised of the main arteries of the Nation. They are the routes that carry the heaviest traffic in normal times and are now further congested with large increments of traffic resulting from emergency activity.

Typical examples of average daily traffic on the most-used portions of the system are 19,158 vehicles a day south of Boston, 54,200 south of Jersey City, 55,900 north of Detroit, 26,650 south of Baltimore, and 17,400 east of Pittsburgh. Peak volumes of double these figures occur. On U S 1 some distance south of Washington the average traffic is 18,000 vehicles per day, but it rises to 89,000 at the crossing of the Potomac River entering Washington. A peak volume of 118,000 vehicles in 1 day has been observed at this bridge. This is the heaviest volume of traffic on any highway of which the Bureau has a record.

The great importance of giving better service to the swelling volumes of traffic, coupled with the President's request that first priority be given to projects contributing directly to national defense or to essential civilian requirements, resulted in much greater emphasis being given to improvement of the interstate system. During the year work progressed at a rate somewhat higher than in the preceding year but far below that needed to produce a satisfactory system within a reasonable period of time.

About one-third of the Federal-aid primary highway funds assigned to projects approved were for projects on the interstate system. Slightly over 1,000 miles were completed at a total cost of $166,484,000. At the end of the year 1,516 miles were under construction at a total cost of $358,186,000.

Table 11 of the appendix shows the status of this improvement program by States. Federal expenditures on the interstate system are made from funds provided for the Federal-aid primary system and for urban highway improvements. Table 11 therefore shows mileage and funds also included in tables relating to the Federal-aid primary system and urban improvements.

The improvements needed on the interstate system, particularly on the approaches to cities and on routes through them, are generally such large undertakings that they must be accomplished a section at a time, spreading the entire improvement over a period of years. Such sections are under way in practically every large city. Most of the large projects described in the following pages are on the interstate system.

Improvement of Urban Highways

The urban highway program continued at the greatest speed possible with available funds. Federal funds expended were equal to the funds authorized for urban work. The apportionment of such funds for the year was $108,281,250. Urban funds involved in projects programed during the year were $129,140,762, and in projects for which contracts were awarded were $112,936,329.

The new census resulted in numerous changes in city populations and the distribution of urban populations among the States: 398 urban places, which previously could not benefit from the urban highway program because their population was less than 5,000, advanced to the above-5,000 population class. The States continued the planning of urban highway systems for improvement with Federal assistance. During the fiscal year, 129 urban systems were approved, so that there are now a total of 274 urban places with approved partial or complete urban systems.

The major portion of funds was applied to substantial improvements, including separation of grades at highways and railroads, major streets, expressways at grade, and freeways. These undertakings have provided freer and safer flow of traffic and have forestalled intolerable congestion.

The greatest congestion and most pressing highway problems are found on urban arterial highways. They form vital links between industrial assembly lines and manufacturers of parts and subassemblies, and are the principal channels of transportation between factories and railroad yards and wharves. There is scarcely a major city in the country where plans for improvement of arterial highways are not under study or actual construction undertaken or completed.

At industrial plants and other establishments essential to national defense, peak loads of traffic occur at shift changes throughout the day and night, but more particularly at the morning and evening periods when work starts and ends. Peak-hour traffic must be accommodated. Resurfacing or widening, with channelization and an occasional grade separation, are resorted to where they will be sufficient, but an expressway with full control of access and all grades separated is often the only satisfactory solution. Neither time nor money is available for early completion of long expressways with numerous structures. As a consequence, the Bureau is approving requests by State highway departments for stage construction that will provide immediate relief at the most seriously congested points, with a view to subsequent construction of an entire facility.

Among the important expressways started in previous years and on which work continued during the year are the John C. Lodge and Edsel Ford Expressways in Detroit, the Congress Street Expressway in Chicago, the Hollywood Freeway in Los Angeles, and the Major Deegan Expressway in New York City. Expressways are being constructed in many other cities, including Boston, Providence, Trenton, Atlanta, Cincinnati, New Orleans, Houston, Kansas City, Denver, San Francisco, Seattle, New Haven, and Pittsburgh.

Initial construction on new expressways must often be limited to a few major facilities designed to serve industrial areas. One such project, the Los Angeles River Freeway, is a part of a long-range plan to serve a rapidly growing urban area.

Control of access

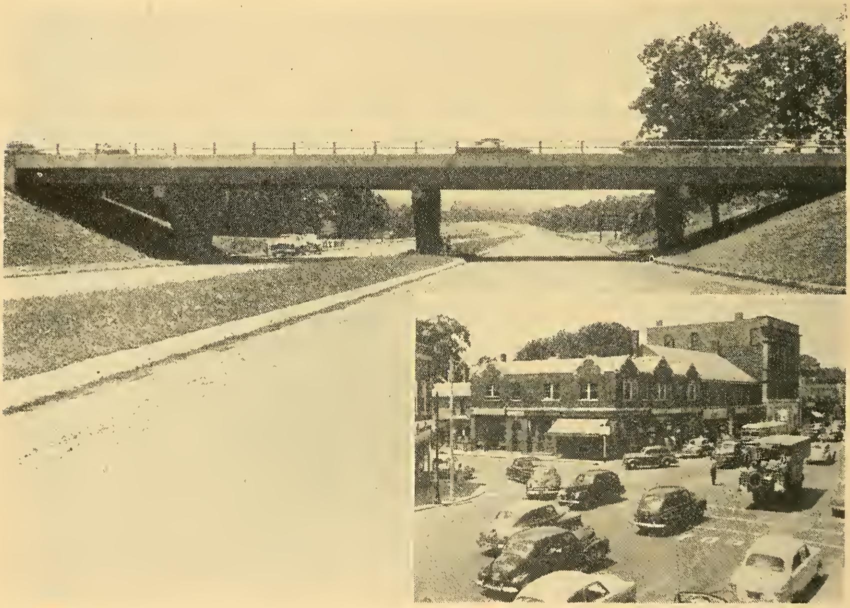
There has been a growing recognition of the many benefits and the long-range economy of control of access on major routes in cities. Where there is no control of access, and roadside businesses develop along the highway, interference between through traffic and the roadside becomes of major importance, reducing the capacity of the highway and increasing accident frequency. As traffic increases, the roadside businesses become more profitable and increase in number, still further increasing interference, lowering capacity, and increasing hazard. Congestion develops, and attempts to correct the deficiency by widening are prevented by the high value of the very businesses which produced the obstructions. Obsolescence grows and authorities are ultimately forced to relocate the highway. This is a wasteful procedure which may be avoided by control of access from the beginning.

Work on Outstanding Projects

The volume of transport by highway of people and goods has surged upward with the growth in national production. In every part of the country great effort has been required to lessen the number of obstacles to transport and thereby lessen its cost in time and money.

There are described below a few examples of the thousands of improvements necessary to feed our people, get them to work, supply the plants in which they are employed, deliver the products, and serve many kinds of defense establishments.

Northern Circumferential Highway around Boston.—The Northern Circumferential Highway, a 28-mile divided highway with controlled access, was very nearly completed. It skirts the congested areas of Boston and forms an important segment of the cross-State highway system which connects with highways in adjoining States. The highway is entirely on new location, sweeping through 10 communities on an arc about 12 miles from downtown Boston. It will serve about 20,000 vehicles a day.

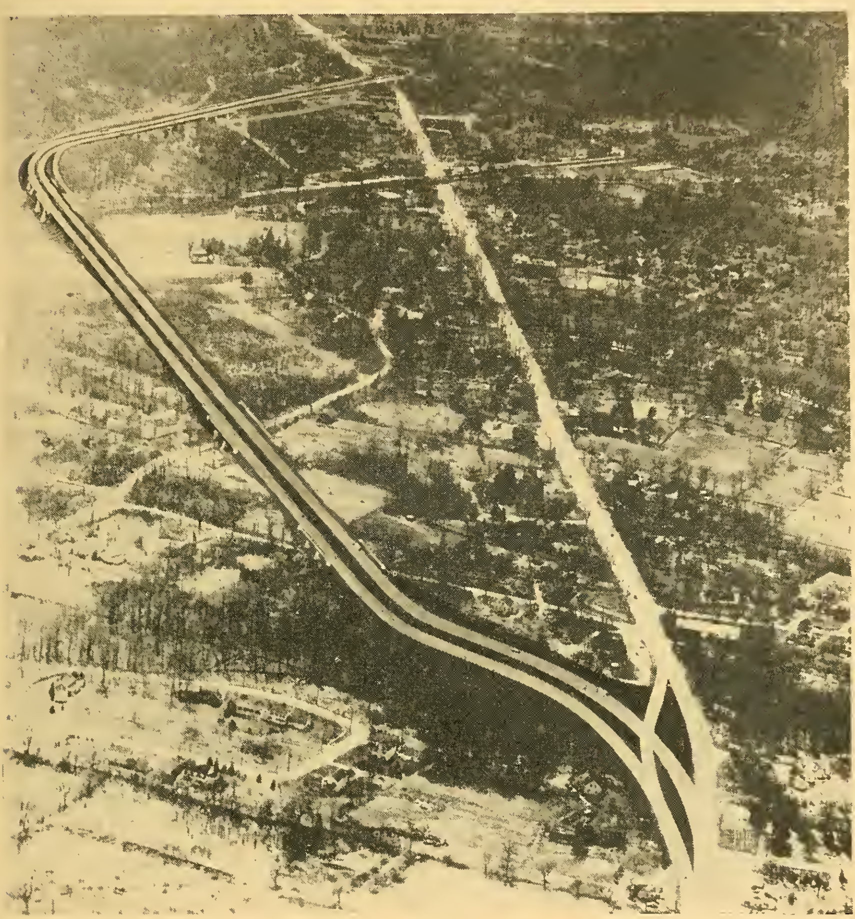


Traffic avoiding the congestion of Boston will now use an expressway instead of the route illustrated in the inset.

Travel time on the new route will be one-half of that necessary on the historic but inadequate and circuitous road which it replaces. The narrow roadway on the old road, with 34 bad curves and frequent crossing streets, resulted in 220 accidents annually. The new highway has 39 highway grade separations, 10 railroad grade separations, and 5 river structures.

Several defense plants are already being constructed in locations which take advantage of interchanges on the expressway, indicating a trend toward the development of residential and industrial areas in proximity to the new highway.

Relocation of U S 1 at Darien, Conn.—Darien, Conn., is on what was in colonial days the Boston Post Road and in modern times U S 1, and is now a section of the National System of Interstate Highways. It is the only feasible truck route from metropolitan New York to industrial cities in Connecticut and eastern New England. Traffic of 16,500 vehicles per day uses the old two-lane road. An underpass of inadequate clearance daily forces 1,100 tractor-trucks with semitrailers to divert to narrow residential streets because they cannot get through the underpass. They are bound to or from factories engaged in defense work, such as Remington (munitions and arms), General Electric (electronic equipment), Jenkins (valves), Singer Sewing Machine (arms), Bridgeport Brass, Sikorsky Aircraft, United States Rubber, Chase Brass, Anaconda Copper, New Departure (bearings), Pratt & Whitney (aircraft engines), Winchester Arms, and those of many smaller companies.



Relocation of U S 1 at Darien, Conn.

Accidents per million vehicle-miles of travel on the section of highway have been thirteen times as frequent as on highways in general in the State.

To remedy the intolerable condition, with its depressing effect upon the entire city, there is now under construction a modern controlled-access, high-speed, divided highway with a length of 1.9 miles. It has one major railroad grade-separation structure and four highway grade-separation structures.

This project is so designed that it can be extended at both ends to form a part of eventual improvement from the New York State line to New Haven and on to metropolitan Boston.

New Jersey opens first section of Trenton Freeway.—For many years traffic on U S 1 through Trenton, N. J., has had to use congested streets through the central business and industrial areas of the city. The route is on the National System of Interstate Highways. To eliminate the delays to through traffic and relieve congestion within the city, a freeway is now being built at the edge of the central area.

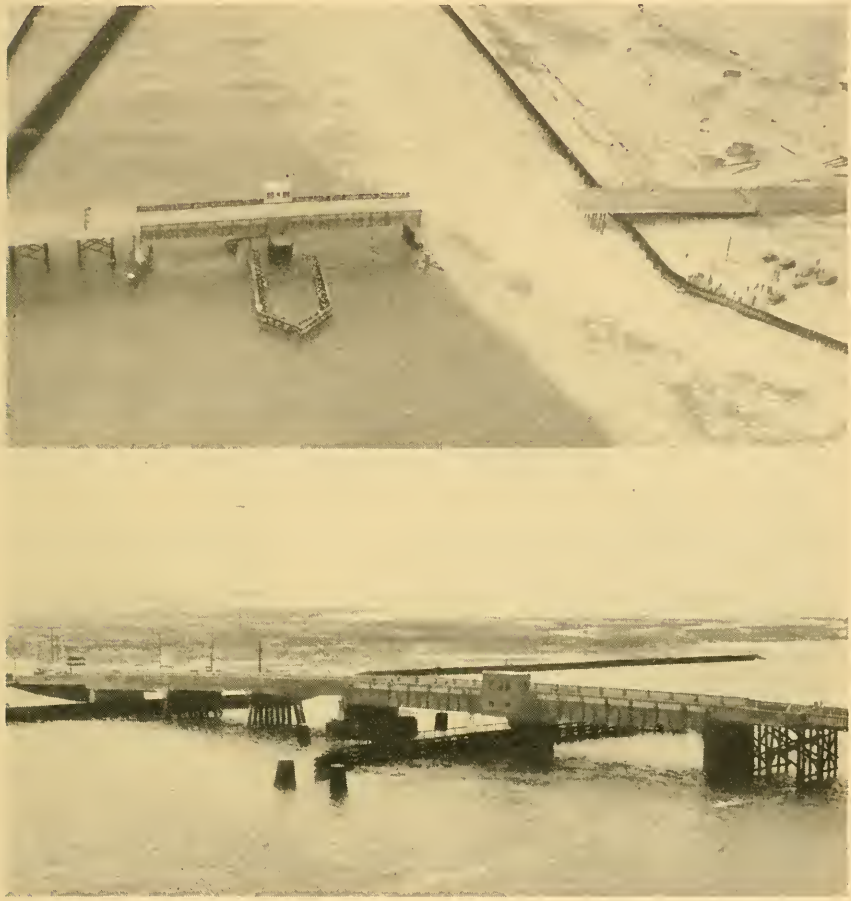
Since this freeway passes through a completely developed area, there have been many unusual construction features. One section is located over an old canal now supplying water for industrial uses. Here the road is being built on top of a concrete culvert. At another location, it was necessary to divert a stream through a long culvert under deep fill and to relocate a section of railroad and construct sections of two streets in order to provide for an important interchange.

The Trenton Freeway.

The first section of this improvement, between two major interchanges, is now open to traffic. When completed, the freeway will allow traffic to flow without interruption from the Pennsylvania State line at the Delaware River to the existing U S 1 north of Trenton. This improvement will be of great benefit to traffic to and from the many defense industries located in Trenton. It will be of particular benefit to the huge Fairless Steel Plant of the United States Steel Corp. now being rushed to completion near Morrisville, just across the river in Pennsylvania. It will be of general service to all through traffic and will furnish relief on the congested streets of Trenton.

Indian River Inlet bridge.—In 1948 ice formations up to 10 feet thick moved out of Delaware Bay into the ocean and were then driven by a strong wind into

Indian River Bay, where they swept away a portion of the bridge across the inlet. Three lives and two vehicles were lost in the disaster. Traffic which normally traveled 12½ miles along the Ocean Highway from Rehoboth Beach to Bethany Beach was detoured 33 miles inland. Ocean Highway serves a resort area that is also used by military authorities as a permanent base and as a training area. Replacement of the destroyed portion of the bridge was completed in the fiscal year by the State of Delaware.



Damage to the Indian River Inlet bridge in Delaware by ice, and the replaced structure.

Pennsylvania develops route for industrial traffic.—The development of a four-lane divided highway on the route of the interstate system between Harrisburg, Pa., and the Pennsylvania-New Jersey line at Easton (U S 22) continued during the year with the completion of an 8½-mile section approximately 40 miles east of Harrisburg, and with the initiation of construction on the more heavily congested section of the route through the Allentown-Bethlehem-Easton area. Plans have also been completed or are in the process of development for improvement to interstate system standards of the remaining portion of the route between Harrisburg and Allentown.

The section through the Allentown-Bethlehem-Easton area, locally known as the Allentown-Bethlehem bypass, is on new location lying to the north of the present highway which follows a circuitous route through the city streets of these contiguous urban areas. Traffic is badly congested on U S 22 through the two cities, and peak-hour loads result in vehicles being backed up for considerable distances. Heavy cross traffic at many intersecting streets has necessitated placement of traffic lights which impede free movement on the through route.

The facility now under construction will be a four-lane controlled-access highway approximately 22 miles in length, beginning at a point west of Allentown and extending to the Delaware River Bridge leading into New Jersey. Upon completion of the entire highway, substantial permanent relief from congestion will be provided. Travel time will be reduced materially for the heavy interstate traffic between the New York City metropolitan area and Pennsylvania's large industrial centers at Pittsburgh, Harrisburg, Reading, Allentown, and Bethlehem.

Bridge replacement in Ohio.—Replacement of old bridges is an activity that must go on in Ohio (as in all States) if the highway system is to continue to give service. Vehicles can move, after a fashion, over an old highway filled with holes; but all traffic stops when a bridge collapses into the stream. For some years Ohio has been faced with the problem of replacing many bridges that cannot be depended upon to carry the heavy loads now moving over roads of all classes.

The 18,000-mile system of Ohio State highways has 6,300 bridges over 20 feet in span. Many are 60 or 70 years old and some were built before the Civil War. That so many are still in use is high tribute to the builders. The State is far behind in its renewal program, since 2,500 bridges are posted for loads less than is legally permissible on the highways. In some instances it is necessary for school busses to stop at a bridge, discharge the passengers, cross the bridge empty, and then pick up the passengers on the other side, because the bridge is too weak to risk crossing with a load of school children.

Ohio is both an agricultural and industrial State and cannot afford to have gaps in its transport system due to fallen or closed bridges. During the calendar year 1950, plans were approved for 110 bridges to be built with Federal aid. Many of these bridges were under construction at the end of the fiscal year.

Road to Savannah River Atomic Energy plant.—Early in December 1950 the Atomic Energy Commission requested construction of an access road to its projected plant on the Savannah River southeast of Augusta, Ga., and south of Aiken, S. C. It was stipulated that the roadway must accommodate 5,000 vehicles an hour and that it must be available for the plant traffic by July 1, 1951.

On December 4, 1950, the South Carolina State Highway Department, working in collaboration with the Bureau, began the preliminary engineering work on the project. A contract for construction was awarded January 9, 1951, and construction began January 15. The highway was open to traffic on July 1.

The entire improvement involved the construction of approximately 17 miles of four-lane divided highway and 4 miles of two-lane undivided highway, and a number of grade separation structures, some of which were still being worked on at the end of the year.

Ninety miles of multilane highway in and near Atlanta.—The four-lane highway from Atlanta to Marietta, Ga., is being extended northerly on new location about 30 miles, avoiding the small congested communities en route and skirting the Cartersville urban area.

The original 18-foot pavement follows winding location through the valleys and gaps of the north Georgia mountains. Traffic delays and highway accidents on the old road have been high due to traffic volumes reaching 10,000 vehicles daily, including 1,200 heavy trucks and tractor-trailers. The new location was selected to permit construction to standards for the interstate system and to avoid the newly inundated Allatoona Reservoir. Road deficiencies were factors in 73 of the 104 accidents occurring in 1949 on the 20 miles of the old road between Marietta and Cartersville.

The improvement connects with a six-lane expressway under construction on U S 41 through the Atlanta area. Surveys, plans, and acquisition of right-of-way are under way to extend four-lane improvements 40 miles south of Atlanta to Griffin. When complete, these 90 miles of modern multilane improvements will save 6 million hours in travel time annually and will substantially reduce the exceedingly high accident rate.

U S 41 is a part of the National System of Interstate Highways and connects the Central States with the resort and metropolitan areas in Georgia and Florida. It directly serves the Lockheed Aircraft plant and Dobbins Air Base at Marietta and many defense installations in the Atlanta and Macon metropolitan areas. It is also the fixed route for many commercial truck and bus lines interchanging freight and passengers between the South and the Central States.

Obstacles to traffic, such as this substandard underpass, were eliminated by the modern four-lane improvement of U S 41 between Atlanta and Marietta, Ga.

Emergency action in Kentucky.—Construction of the Kentucky Area plant of the Atomic Energy Commission, located 16 miles west of downtown Paducah, Ky., was started during the year and is expected to be completed late in 1952 at a cost in excess of $330 million. During this period a maximum of 12,500 workers will be employed daily, but thereafter a much smaller force will operate the plant. The need for daily travel by large numbers of workers is temporary. As the number of plant employees was rapidly increasing each day, the necessity for early action was evident. Studies made indicated that in addition to the present approach roads, two additional lanes for peak-load traffic from Paducah were necessary. These lanes were provided by widening portions of the existing roads to three lanes, which allows the use of two lanes in the direction of peak traffic. A three-lane road is seldom desirable but in this instance it provides a quick and relatively cheap solution. When the plant is completed, the road will be reconverted to two lanes.

The Detroit expressways.—July 9, 1951, was the beginning of a new era of automobile transportation in Detroit. The first section of the Edsel Ford Expressway, extending from the west corporate limits of Detroit easterly about 2 miles, was formally dedicated. The improvement is depressed below ground level, with all principal intersecting streets carried over the six expressway lanes. Frontage roads are provided at ground level for local traffic. The completed section was financed jointly by the Federal Government, the State of Michigan, Wayne County, and the City of Detroit.

The Edsel Ford Expressway in Detroit.

In addition to serving the high volume of traffic using the expressway, movement of the tremendously large volume of raw materials and mechanical parts which are transported by truck between the important industries of the Detroit area will be expedited by the reduced congestion already noticeable adjacent to the section completed.

The remaining 3 miles of this expressway and the 3½ miles of the connecting John C. Lodge Expressway are partially under construction and should be opened to traffic in 1953.

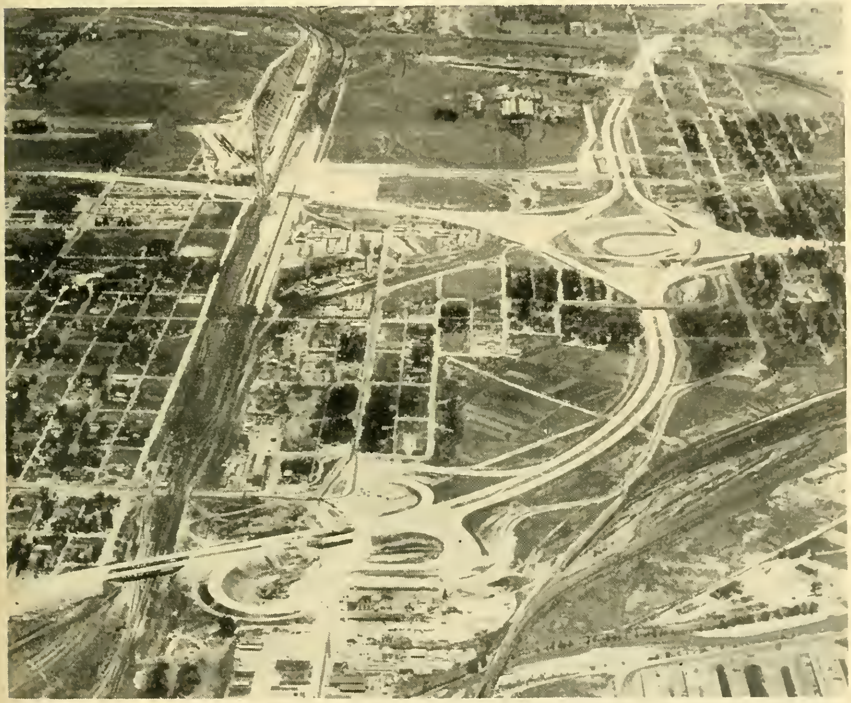
The extension of the Edsel Ford Expressway to the northeast corporate limits of Detroit and of the John C. Lodge Expressway to the north limits of Detroit are now in the planning stage, and will be advanced to construction as soon as funds from a bond issue recently authorized by the legislature are made available. This method of financing will advance the completion of these vital traffic arteries by several years.

Twin Cities-Duluth highway.—Since World War II, planning officials of the Minnesota Department of Highways and the Bureau have been well aware of the need for improvement of U S 61, a major link in the interstate system connecting Duluth with Minneapolis and St. Paul.

Duluth is at the head of the Great Lakes and serves as a distributing center for shipping arriving via Lake Superior, including products destined for Minneapolis-St. Paul and the iron range cities to the north. Duluth is the shipping center for iron ore from the Minnesota iron range to the steel mills near the eastern Great Lakes.

Prior to the present program of reconstruction U S 61 consisted of approximately 150 miles of old concrete constructed in the early 1920's. The highway as it now exists, with its narrow 18-foot width, numerous sharp curves, and hazardous summits, is obsolete for the daily traffic of 2,500 vehicles. The pavement is rough and cracked. Much of the new improvement consists of a 24-foot bituminous surface, with 8-foot gravel shoulders, flat curves, and unrestricted sight distances. Divided highways are constructed in the more congested areas approaching major towns and cities.

Reconstruction was begun in 1947 on 4 miles of divided highway approaching Duluth. Since that time the State has completed 33 miles of roadway. At the end of the year 35 miles were under construction and contracts were to be let for 15 miles more. The State intends to put an additional 37 miles under construction by 1952. Work will probably be started on the remaining 15 miles in 1953, which will result in the completion of the entire rural length by 1954 or 1955. Federal aid has been used on all of the work.



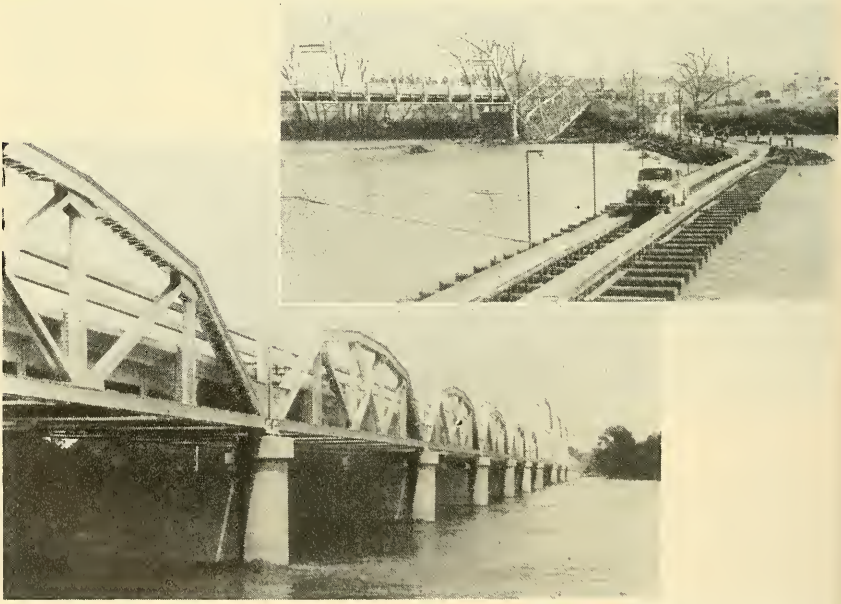
The Valley Freeway in Denver.

Valley Freeway in Denver.—For several years Denver debated what to do about its growing traffic problems, but it is now making good progress on a major improvement known as the Valley Freeway, a four-lane divided highway with controlled access. It traverses the city in a north-south direction along the Platte River Valley, passing west of the business section and thence southeasterly, for a total length in the city of 9.3 miles. Grades of cross streets are to be separated and adequate interchanges provided. About 2¾ miles on the north end are substantially completed, with a connection to serve the northwest section of the city. Work will be continued by sections as funds permit until the entire improvement is completed. This route is a part of the interstate system.

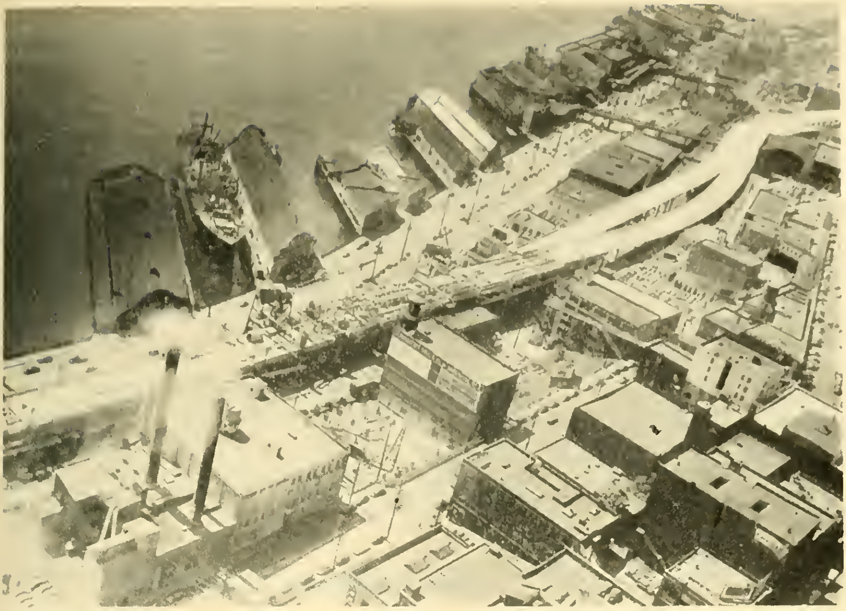
Approach to Pacheco Pass in California.—A recently completed section of highway has provided a long desired improvement on the westerly approach to Pacheco Pass in California—one of the few usable passes through the Coast Range separating the Santa Clara and San Joaquin Valleys. In 1858 this pass was used by the Butterfield Overland Stage in delivering the first United States mail to San Francisco via the overland route from St. Louis. The reconstruction on new location provides 3.3 miles of four-lane divided highway on a good alinement, with no gradient over 6 percent. A widened area is provided on both sides of the highway at the summit where trucks may park off the highway for mechanical inspection before starting to descend the sustained grades on either side of the mountain range.

The improvement eliminates a narrow and tortuous two-lane road on which there were 28 curves, 17 of which had radii between 100 and 400 feet. While the old road would have appeared more than adequate to Butterfield stage drivers, it had long been inadequate for the daily traffic of 4,000 vehicles, of which some 500 are heavy trucks. The new facility has eliminated the long strings of passenger cars following trucks which crawled up the old grade, and has greatly reduced the accident rate. The picture on the cover shows the marked improvement made in this important road.

Bridge at Ponca City, Okla.—Replacement of weak and obsolete bridges is as urgent as any part of the highway program. Because of lack of funds the States are not always able to replace bridges as they become unsafe. Every year there are a number of bridge failures caused by heavy loads or a vehicle striking a critical part of the bridge. The accompanying illustration shows what happened to an old bridge on U S 60 near Ponca City, Okla., when a truck hit the truss. The replacement structure, completed with Federal aid, is shown in the inset.



Bridge span on U S 60 in Oklahoma destroyed by truck collision, and the replacement structure.



The Alaskan Way in Seattle.

The Alaskan Way in Seattle.—Seattle occupies a confined area between Puget Sound on the west and Lake Washington on the east. Traffic generated in this metropolitan area, with a population of approximately one-half million people, is predominantly a north-south movement due to the natural barriers. There is great congestion on the north-south streets passing through the central business district. These streets also carry through traffic on the Pacific Highway (U S 99), the heaviest traveled route in the State of Washington.

To provide major relief, the Alaskan Way was developed as a central business district bypass. Traffic surveys indicated that sufficient traffic desires to avoid the central business district to warrant construction of a six-lane freeway. Conditions made it necessary to use both subway and viaduct construction. The first section on the project was completed during the year but three additional contracts will be required to complete a usable facility. Work on all of these sections was expected to be under way within a few months. This project is of great importance to one of the principal ports of the country.

Rehabilitation of U S 30 in Iowa.—U S 30 in Iowa, a 346-mile route from the Missouri River to the Mississippi River across the central part of the State, is an important cross-country route and carries a heavy load of local and interstate trucking. The route serves the industrial center of Cedar Rapids where plants of the Quaker Oats Company, Penick & Ford, LaPlante Choate Company, Link-Belt Speeder, Iowa Manufacturing Company, Wilson & Company, Collins Radio Company, and many smaller manufacturers are located. It also serves numerous local produce centers and carries a heavy transport of livestock to the packing industry in Omaha, Nebr. The average traffic over the route in 1950 was 2,634 vehicles per day, of which 22 percent were trucks and busses. The average daily traffic reached a maximum 4,500 vehicles on some rural sections with 25 percent trucks and busses.

Most of the route was paved with 18-foot concrete pavement during the late twenties and early thirties. Due to heavy truckloads during the war years, the increased traffic load since the war, the disintegration of concrete on some sections, and the 20- to 25-year age of the pavement, much of the route has deteriorated to a condition entirely inadequate for existing traffic. During the exceedingly cold winter and wet spring of 1950–51 the bottom literally fell out on some sections, adding to already increasing traffic hazards and maintenance costs.

After World War II, the Iowa State Highway Commission initiated a long-range program for reconstruction of U S 30. One 10-mile relocation was completed in 1949 with Federal-aid assistance. A program of resurfacing of existing concrete pavements, with some grade improvements, new bridges, and widened and regraded right-of-way, was initiated in 1949 and has resulted in completion during the past year of 21 miles of reinforced concrete pavement and 15 miles of asphaltic concrete pavement. Nine miles of concrete and 12 miles of asphaltic concrete were nearing completion at the end of the year. Wherever resurfacing is done, width is increased to 24 feet.

In addition, one city project has been completed and another with a grade separation is under construction. Both have four-lane reinforced concrete pavements and total 1.8 miles in length. At the end of the year the State was completing plans for two major relocations of U S 30 totaling 29 miles and involving extensive grading and several bridges. Federal funds have been used on 69 miles of recent improvements.

Secondary or Farm-to-Market Roads

The 13,803 miles of secondary or farm-to-market roads completed during the year exceeded the accomplishment of the previous year by nearly 600 miles and established a new record. The mileage is almost enough to reach across the continent five times. The new mileage, added to that previously completed, brings the total for this program to 55,483 miles—enough to reach more than twice around the world. Work of the year was financed by an authorization of $135 million and amounts remaining from previous authorizations.

At the end of the year, 7,915 miles were under construction, work was soon to begin on 2,292 miles for which contracts had been awarded, plans were approved for 2,013 miles, and programs had been approved for an additional 10,889 miles. The mileage under construction was about 1,100 miles less than at the end of the previous year—an indication of the dampening effect of defense activity on construction of secondary roads.

The above figures indicate almost 79,000 miles of secondary road improvement. Remainders of apportioned funds not assigned to projects as of June 30, 1951, and funds to be apportioned for the fiscal year beginning July 1, 1952, should provide the Federal share on about 29,000 miles.

The system of Federal-aid secondary roads is not arbitrarily limited in extent but roads to be eligible for improvement with Federal-aid secondary funds must lie on the system. All roads on the system have been cooperatively selected by State and local officials and approved by the Bureau. At the end of the year the system totaled 415,374 miles in the 48 States, and 416,989 miles if portions in Hawaii, Puerto Rico, and the District of Columbia are included.

The legislation of 1950 provided that " * * * any State desiring to avail itself of the benefits of the funds apportioned for expenditure on the Federal-aid secondary highway system shall establish in its State highway department within six months after the close of the next regular session of its legislature, a secondary road unit and such department shall be suitably organized to discharge to the satisfaction of the Secretary of Commerce, the duties herein required: Provided, that any State highway department may arrange with any county or group of counties having competent highway engineering personnel, suitably organized and equipped to the satisfaction of the State highway department, to supervise construction and maintenance on a county-unit or group-unit basis for the construction and maintenance of secondary road projects * * * ”

As a result of this provision, all States are examining their administrative organizations and procedures, proposing such administrative and legislative changes as are necessary to meet the requirements, and submitting them to the Bureau for approval. At the end of the fiscal year, changes in two States had been approved and other States were submitting their proposals. It is interesting to note that during the year one additional State—Mississippi—passed legislation requiring the employment of county highway engineers for the management of county highway operations. This makes the sixteenth State where local highway organizations, in general, are now considered competent to handle the engineering work necessary in the Federal-aid secondary program.

The board of county consultants, comprised of one county engineer or county official from each of the 10 operating divisions of the Bureau, is being continued as a fixed policy of the Bureau. The board members act in a consulting and advisory capacity on the many troublesome administrative problems which arise in a program involving more than 3,000 units of government. Their advice is highly respected.

Highway Improvement Under Direct Supervision of the Bureau

The Bureau, as the principal road-building agency of the Federal Government, receives annual appropriations for work on major highways through National forests. A large amount of highway engineering and construction supervision is also done by the Bureau for other government agencies, sometimes as a result of legislative requirements and sometimes at the voluntary request of agencies desiring to take advantage of an organization equipped for prompt action. In such work the Bureau prepares plans, awards contracts, and supervises construction. The extent of these activities during the fiscal year is indicated below.

Forest highways	[2] $19,509,204
Park roads and trails	[3] 2,646,014
Parkways	[3] 4,013,269
Forest development roads	610,951
Cooperative work, forest highways (contributions for local work)	674,490
Virgin Islands	71,400
Los Alamos roads (Atomic Energy Commission)	20,495
Arco Road (Atomic Energy Commission)	576,510
Emergency reconstruction and repairs (Forest Service)	234,149
Roads, bridges, and trails in Alaska:	
Turnagain Arm	1,936,996
Other highways	1,076,194
Construction in interior Alaska for Alaska Road Commission	[4] 2,119,138
Bonneville transmission-line access road	116,347
Roads for Bureau of Land Management	73,868
Total	33,679,025

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[2] Includes $7,500 transferred to Forest Service for minor work.

[3] Includes expenditures by National Park Service.

[4] Estimated value of payments made by Alaska Road Commission.

Forest highways

The Federal Government has been constructing and improving highways through National forests for about 35 years. Programs of projects on the major highways are agreed upon jointly by the Forest Service, the State highway departments, and the Bureau, and survey, design, construction, and maintenance are done under the direct supervision of the Bureau.

Some of the Forest highways coincide with sections of the interstate system, and 41 percent are on the Federal-aid highway system and 33 percent are on the Federal-aid secondary system. The remainder are local roads for forest protection and administration and access roads to natural resources and recreation attractions. A compelling reason for Federal financing and supervision of construction of these roads is the obligation incurred by reserving great areas of land for public use. Highways must be built across these areas to give outlets to many isolated communities, to permit development of State systems with reasonable directness of travel, and to make possible interstate and transcontinental routes. Forest highways form necessary links in highway systems of all classes.

The need for improvement of these links has increased with the enormous growth of highway transportation, and with the growth in population and activities in the areas surrounding the forests.

The gap between existing road conditions and urgently needed improvements has become wider than ever before. Because most forest roads are in mountainous areas, the dangers and deficiencies of the older roads are more conspicuous than in most parts of the country.

Available funds have been concentrated very largely on reconditioning and modernizing highways built in the earlier years according to standards much lower than are now required. It was not possible to recondition many of the roads in bad condition or to provide new construction that is much needed.

Forest highway systems include 10,938 miles in the eastern and central portions of the country and 12,374 miles in the west and in Alaska. During the year improvements were completed on 568 miles at a total cost of $22,689,006. At the end of the year 428 miles were under construction at a total cost of $17,409,096. Details by States are given in table 17 of the appendix. Typical forest highway improvements are described below.

Randle-Yakima Highway.—This 72-mile forest highway is a part of the State highway system of Washington. It is a rather long route that has been highly expensive to construct. Construction by sections with forest highway funds on the western side of White Pass has been in progress for some 20 years. The State has completed the road on the east side of the pass with its own funds. There has been insistent demand for completion of this route to permit satisfactory travel between Yakima Valley and southwest Washington. The route crosses White Pass at an elevation of 4,500 feet and will serve traffic that has had to use an indirect route through Chinook Pass, at an elevation of 5,440 feet, which is blocked with snow for several months each year. Twenty miles of travel will be saved. During the year work progressed on the last gap in the White Pass route and completion was expected shortly after the end of the year.

Ketchum-Clayton Highway.—Construction of this 118-mile route in Idaho was begun in 1919 and year by year successive sections were improved. The character of the improvement was influenced by the rugged country traversed, the necessity of completing the improvement within a reasonable period of years, and the relatively small volume of traffic expected at the time. The old improvement has been obsolete for some years. During the year work progressed on reconstruction of the highway to modern standards, including replacement of inadequate bridges. This project is typical of the general forest highway program.

North Santiam Highway.—In Oregon it has been necessary to relocate 15.6 miles of forest highway because of construction of Detroit Dam and the resulting reservoir. The work is being paid for very largely with funds provided for the power project. Work on the highway relocation was started in 1947 and was very nearly completed at the end of the year.

National park highways, park approach roads, and parkways

Programs for the improvement of highways making National parks accessible to the public, and for parkways, are developed in cooperation with the National Park Service. Construction contracts are awarded by the Secretary of the Interior but the Bureau does all engineering work for major improvements, including supervision of construction.

Progress in improvement was about the same as in the previous year. Highways completed amounted to 116 miles, and 264 miles were under construction at the end of the year. Details are given in tables 18 and 19 of the appendix.

The Bureau and the National Park Service continued the joint undertaking of planning park highway systems and approach roads to serve adequately the increasing number of tourists visiting the park areas each year. Examples of current park improvements follow.

Going-To-The-Sun Highway.—This highway in Glacier National Park was the first constructed by the Bureau for the National Park Service. Since its construction 25 years ago, some portions have become obsolete. Maintenance to accommodate the large volume of summer tourists became highly expensive. Reconstruction of sections of the highway was begun.

Blue Ridge Parkway.—This parkway, 478 miles in length, extends between the Shenandoah National Park in Virginia and the Great Smoky Mountains National Park in North Carolina. It is an outstanding scenic route and completed sections are already used by large numbers of tourists. Construction work was started in 1935, and the present status of the parkway is as follows: 254 miles paved, 14 miles of base course not yet paved, 11 miles of earth grading under way, 69 miles of paving under construction, and 130 miles not as yet graded. The 58 miles of construction completed during the year and 80 miles under construction at the end of the year indicate the interest in completing this parkway as soon as possible.

Baltimore-Washington Parkway.—Completion of a parkway approach to Washington from Baltimore has been needed for many years. The parkway planned is to have all of the features of an express highway. The divided roadway will have no cross traffic, and a wide right-of-way will assure permanent parkway conditions. Maryland is to build approximately half of the improvement as a Federal-aid project and the other half, 18.5 miles, is to be built with parkway funds.

Work on the section to be built entirely with Federal funds has been in progress since 1945, but the rate of improvement has been rather slow because of the limited funds available. Additional funds provided during the year have permitted acceleration of progress. Six miles of grading had been completed in previous years. Work was begun on an additional 3.5 miles of grading and on nine bridges.

Forest development roads

By agreement with the Forest Service of the Department of Agriculture, the Bureau, when requested, makes surveys, prepares plans, and supervises construction of forest development roads. These roads are of primary importance for the protection, administration, and utilization of the National forests. They are feeder roads to the forest highways. A considerable volume of this work is performed by the Bureau.

During the fiscal year this work involved surveys for 238 miles and construction of 76 miles.

Public land highways

The Federal-aid Highway Act of 1950 authorized funds for the survey, construction, reconstruction, and maintenance of main roads through unappropriated and unreserved public lands, nontaxable Indian lands, and other Federal reservations. These funds were made available directly to the Bureau. Contracts were awarded for 43 miles of highway to cost $750,000 and construction was begun.

Access roads to defense establishments

During World War II the construction of 1,252 bridges and 12,914 miles of access roads to military and naval reservations, to defense industries, and to sources of raw materials, was accomplished with the assistance of many of the State highway departments. The Federal-aid Highway Act of 1950 authorized $10 million for the same purposes. It required that improvements undertaken be certified as important to the national defense by the Secretary of Defense or such other official as the President may designate. Eligible roads are generally those needed to serve new defense traffic of temporary duration for the period of the emergency. The funds are applied only on work that cannot be financed appropriately by regular Federal-aid and other funds.

Contract authority for $2 million was provided in the act and is included in the total of $7 million that has been appropriated or transferred from Defense Highway Act funds. By April 1951 the $7 million thus made available was allocated to certified projects with the exception of a small sum held for contingencies.

By the end of the fiscal year there were 24 projects certified by the Secretary of Defense or by the Secretary of the Interior, who has been designated to certify roads to sources of critical and strategic minerals and metals. These 24 projects were estimated to cost $13,790,740, with $13,334,544 to be financed with access-road funds. There were 26 projects estimated to cost $5,152,743 being considered for certification, and another 59 projects under investigation by field representatives of the Bureau after receipt of a request for assistance from an appropriate official. Construction of access roads contemplated will require the authorization of additional funds.

The list of certified projects includes roads serving two Army installations, three of the Air Force, two of the Navy, and one of the Marine Corps; two tungsten mines, one cobalt mine, one fluorspar mine, and a number of uranium mines; and three Atomic Energy plants. There are also three projects providing for rerouting of public highways being closed by extension of airfield runways.

Construction in Alaska

The Turnagain Arm section of the Seward-Anchorage Highway in Alaska is being constructed by the Bureau under an agreement with the Alaska Road Commission of the Department of Interior. This section extends 47 miles from mile 58 north of Seward around Turnagain Bay to Indian, and is of defense significance.

Construction was started in 1948. Contracts were awarded in the amount of $7,194,658 for grading and drainage structures and by the end of the past fiscal year the project was practically completed.

The section of the highway from Seward to mile 58 is being constructed by the Bureau at the request of the Office of Territorial and Island Possessions, following an appropriation to them of $7.5 million for this purpose. Contracts were awarded for grading and bridges to cost $6,358,000. This section is planned for completion in the calendar year 1951. At the end of the fiscal year the work was about 15 percent complete.

Legislation enacted near the end of the fiscal year appropriated $3.5 million for the survey, construction, reconstruction, and maintenance of specific projects in and adjacent to the Tongass National Forest.

An extensive program of road improvements in interior Alaska is being performed by the Bureau under an agreement with the Alaska Road Commission. The work includes surveys, design, and preparation of plans for 613 miles of highway and supervision of reconstruction and bituminous surfacing of 301 miles of the Glenn, Richardson, and Alaska Highways. Work has been completed on 212 miles at a cost of $8,359,887. At the end of the year construction was still in progress on 90 miles at a cost of $3,655,482. The work was 15 percent complete.

Indian reservation roads

Legislation of 1928 authorized appropriations for the improvement of Indian reservation roads not eligible under other Federal highway legislation. Further legislation in 1944 authorized specific appropriations for these roads and provided that the location, type, and design of roads and bridges be approved by the Bureau and that construction be under its general supervision.

Because of the relatively small appropriation, the number and extent of these projects have been small, there being only a few under construction during the past year. In order to improve the economic status of the Indian, these projects have usually been undertaken on a day-labor basis using Indian labor as far as possible. Indian Service personnel usually perform the construction-engineering work with the Bureau of Public Roads reviewing the surveys and design, and making periodic inspection during construction.

The Bureau is cooperating with the Bureau of Indian Affairs in developing a system of highways for each Indian reservation. A large portion of the system of Indian Service roads is planned to serve the needs of the reservation directly. Others serve through traffic and form a part of the transportation system of the State.

Joint Planning of Location of Highways and Airports

The results flowing from the administration of section 11 of the Federal-aid Highway Act of 1944 continue to demonstrate the value of this legislation. The joint planning of highway and airport facilities by representatives of the Bureau, State highway officials, the Civil Aeronautics Administration, State aeronautic commissions, cities, and others responsible for airport and highway improvements, has produced results beneficial to both highway and air transportation.

In carrying out the requirements of the legislation " * * * that the location of such airport or extension thereof and the consequent reconstruction or relocation of the highway are in the public interest" the Bureau during the past year received and acted on more than 100 applications from airport officials requesting concurrence as provided in the act. Such joint planning prevents costly mistakes which otherwise would not become apparent until later when funds would have to be spent for their correction.

Flight Strips

After the ending of World War II, the 26 flight strips built by the Bureau for the Army Air Force, under authority of the Defense Highway Act of 1941, were declared surplus to the needs of the War Department.

In compliance with requests from the several military departments, five flight strips have been reassigned to the Air Force, one to the Army, and two to the Navy. Additional requests are anticipated.

Seven flight strips are under assignment to States or subdivisions of States by lease or permit, for civil aviation purposes, subject to cancellation whenever they may be needed for military purposes.

Repair of War-Damaged Highways

The repair of war-damaged roads, as authorized by the Defense Highway Act of 1941, was in its last stage at the beginning of the year. At the close of the year 293 claims for the repair of 6,254 miles of roads, in the amount of $10,664,798, had been received and recommended for payment.

Funds have been appropriated for payment of 292 of these claims for 6,253 miles of road in the amount of $10,618,275. During the year 35 claims for the repair of 475 miles of road in the amount of $1,207,720 were paid. Three claims were pending at the end of the year. Disposal of these claims will complete the activity resulting from World War II.

Repair of Flood-Damaged Roads

For many years it has been the policy of the Federal Government to extend aid to the States for the repair or reconstruction of highways and bridges damaged or destroyed by floods and other disasters of extraordinary character and extent. In recent years such aid has been available under authorizations permitting the use of available emergency relief funds without waiting for legislative action following each disaster. The Federal-aid Highway Act of 1950 authorized an additional $5 million for this purpose and limited its use to routes on the Federal-aid highway systems.

At the beginning of the fiscal year the emergency relief work previously authorized had been very largely completed.

Allocations of emergency relief funds totaling $3,719,638 were made during the fiscal year to six States and to Hawaii, to assist in rehabilitation work estimated to cost $7½ million. Of the total amount of emergency relief funds allocated, $2,719,638 was for the repair of flood damage which occurred during 1949 and 1950 in five States, and for the construction on relocation of three sections of highway on the west coast of Hawaii which were destroyed by lava flows from 30 to 90 feet deep resulting from the 1950 eruptions of Mauna Loa Volcano. The remaining $1 million was allocated to California for flood damage occurring during November and December of 1950. Minnesota, South Dakota, and North Dakota received a large portion of the emergency relief funds allocated, for use on work necessitated by floods during the spring months of 1950.

Shortly after the end of the fiscal year, disastrous floods occurred in Kansas and Missouri. These States have notified the Bureau of their intention to request allocations of emergency relief funds, and steps were taken to cooperate on rehabilitation work.

Hawaii War and Emergency Damage Program

A Federal fund of $10 million was authorized in 1947 for rehabilitation or repair of roads and bridges in Hawaii damaged by the armed services or by their contractors, and for the restoration or reconstruction of highways and bridges damaged or destroyed by seismic waves in April 1946.

The Territory was required to match Federal funds to the extent required by the Commissioner of Public Roads. On work resulting from damage caused by the seismic wave the Territory has been required to make a contribution equal to that of the Federal Government.

By the end of the fiscal year, programs had been approved for war-damaged highways costing $3,420,533 in Federal funds and for seismic-wave-damaged highways costing $6,113,595 in Federal funds. The total cost of the work, including matching funds, was $16,179,972, providing for the rehabilitation or repair of 271 miles of roadway and bridges.

The Inter-American Highway

The Inter-American Highway is that section of the Pan American Highway System which extends from Nuevo Laredo on our Mexican border to Panama City, a distance of approximately 3,200 miles.

Since 1930 the United States, through the Bureau of Public Roads, has been assisting the Republics of Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama in the construction of the Inter-American Highway. The section of the highway in Mexico has been financed and constructed entirely by Mexico.

The Inter-American Highway is not passable for motor vehicles over its entire length. In Mexico it is open and in excellent condition over all of the distance from the United States to Guatemala, but in northwestern Guatemala, beginning at the Mexican border, there is a gap of 25 miles which is impassable. In northern Costa Rica there is also a gap of about 65 miles, and in southern Costa Rica and western Panama there is another gap of about 150 miles, both of which are impassable. Among those sections which are considered passable there are many that still need improvement because of inadequate surfaces, sharp turns, steep grades, and narrow roadways. However, there are also many miles of excellent modern highway. At present, 63 percent of the highway is paved, another 29 percent is passable at all times, 1 percent is passable only in dry weather, and 7 percent is impassable at all times.

All of the Mexican section of the Inter-American Highway is paved except for about 100 miles near the Guatemala border. This latter stretch has a good crushed-stone surface, usable at all times.

During the year Congress appropriated the sum of $4 million for the continuation of construction of the Inter-American Highway in cooperation with the Central American republics. Funds from previous appropriations have been practically exhausted. Under the terms of the new appropriation act it was necessary that new agreements with these countries be negotiated by the State Department, each country agreeing to the following conditions:

1. To provide all necessary right-of-way for the construction of the highway. (The minimum right-of-way width to be approximately 300 feet in rural areas and 150 feet in municipalities.)

2. Not to impose any highway toll for use of the highway by vehicles or persons.

3. Not to levy any fee, tax, or other charge for the use of the highway by vehicles or persons from the United States that does not apply equally to vehicles or persons of that country.

4. To continue to grant reciprocal recognition of vehicle registration and drivers' licenses in accordance with the provisions of the Convention for the Regulation of Inter-American Automotive Traffic or of any other treaty or convention establishing similar reciprocal recognition.

5. To provide for the maintenance of the highway after its completion in condition to serve adequately the needs of present and future traffic.

Such agreements have been negotiated with El Salvador, Nicaragua, Costa Rica, and Panama. Project statements and memoranda defining the conditions under which the new work will be done have been executed with Nicaragua, Costa Rica, and Panama, and funds have been allotted for specific improvement in these three countries, with construction scheduled to start at the beginning of the dry season in the fall of 1951.

In all countries the rate of progress during the fiscal year has been slow due to the exhaustion of funds previously provided for construction.

In Guatemala, work proceeded near the Mexican border where the route is still impassable. Near the El Salvador border two bridges were completed and a 12-mile section is nearing completion.

In El Salvador and Honduras no work other than maintenance was done. The highway in El Salvador is paved except for 25 miles which are in good condition for all-weather travel.

In Nicaragua the 28-mile section between Jinotepe and Rivas was completed. Bridge surveys and preliminary work were started between Sebaco and the Honduras border.

The only construction work in Costa Rica was that needed to protect the existing improvements from deterioration. Plans are under way for the construction of portions of the highway in the northern section.

In Panama plans have been submitted and an organization is being set up to start construction of a section of the highway starting at David and proceeding south.

Projects other than the Inter-American Highway

The Bureau of Public Roads has continued its technical assistance to the Government of El Salvador in the construction of a bridge over the Lempa River at San Marcos (not on the Inter-American Highway).

At the request of the Costa Rican Government, a superintendent of construction has been sent to that country to assist in the organization of a maintenance department, and in the improvement of maintenance methods.

An engineer was also sent to Honduras at the request of that Government to assist in the planning of a national system of highways.

The Bureau has been providing technical advice and assistance to the Government of Ecuador in the construction of a portion of the highway which eventually will connect Quito, the capital, with the new port of Manta. One engineer has been assigned to this project.

The Bureau has continued its assistance to the Government of Peru in preparing a plan for the reorganization of their highway department and in studies to aid them in the development of an improved highway system. Three engineers were assigned to this work at the start of the fiscal year, and at the end of the year one still remained on the assignment.

During the year, the Government of Colombia asked the Bureau for the services of a highway economist to assist them in the application of economic studies in the planning of a national highway system. One man was assigned to the work. The highway engineer who was sent to the State of Cundinamarca in Colombia the previous year, to assist in the planning and construction of a State system of highways, completed his assignment.

Rehabilitation of Philippine Highways

Under the Philippine Rehabilitation Act of 1946, $40,040,000 was authorized for the repair and reconstruction of roads, streets, and bridges in the Philippines in cooperation with the Philippine Government. The program was originally scheduled to end June 30, 1950, but the size and complexity of the job in the face of the war-ravaged condition of the Philippines made it necessary to extend the life of the program through June 1951.

The program, as it finally crystallized, included the following:

1. Repair or complete reconstruction of 263 major bridges. So great was the damage suffered by bridges during the war that their reconstruction was a prime essential to the economic recovery of the islands. Construction of several large new bridges, necessary for the economic development of the Philippines, also was included in the program.

2. Procurement by the Bureau of Public Roads of 2,000 metric tons of reinforcing steel and certain items of equipment to be used in the reconstruction of 239 minor bridges, the actual construction being carried out with Philippine funds. By this means the Bureau was able to stimulate reconstruction and initiative by the Philippine Bureau of Public Works far beyond the immediate rehabilitation program.

3. Construction of 243 miles of asphalt surfacing, 78 miles of concrete, and 38 miles of improved gravel-surfaced roads and city streets. Lack of maintenance during the war and heavy postwar traffic had made many of these roads and streets dangerous and in some cases almost impassable.

4. Procurement by the Bureau of some $900,000 worth of construction equipment. This equipment has been turned over to the Philippine Bureau of Public Works. Purchased primarily to hasten the completion of rehabilitation projects, the equipment will be useful in subsequent construction by the Philippine Government. Rehabilitation funds were used in the construction of a 180- by 40-foot warehouse for housing equipment and spare parts.

5. A year's specialized training in highway work of 10 Filipino engineers in the United States, under the auspices of the Bureau of Public Roads. The men so trained occupy responsible positions in the Philippine Government.

6. Completion of highway planning surveys, including a complete inventory of all highway facilities throughout the islands, detailed traffic studies in most important cities, financial studies revealing for the first time the resources of and expenditures on the Philippine highway system, and the formulation of long-range plans for the future development of highways.

7. Establishment of a materials department and laboratory within the Bureau of Public Works for the testing of highway materials.

The Bureau continued its education program in the Philippines during the fiscal year. A 157-page bridge construction manual and a series of standard bridge designs were prepared and distributed. Filipino engineers employed by the Bureau as designers and inspectors have continued to receive practical on-the-job training in highway and bridge engineering. The Bureau's division engineer and his assistants gave a lecture course on highway engineering at the University of the Philippines.

At the beginning of the fiscal year, 179 projects were under construction or not yet begun. By the end of the year, 112 of these projects were completed. Thirty-four others were more than 70 percent complete.

Two major jobs completed during the year were the General MacArthur Bridge and the Ayala Bridge, both of which span the Pasig River in downtown Manila. Each of these bridges carries between 20,000 and 30,000 vehicles per day.

Four street-paving projects in Cebu City, second largest port in the islands, were completed. City streets in Cebu were heavily damaged during the war and their resurfacing has greatly eased the traffic problem, particularly on the approaches to the dock area. Rock asphalt, a native road-surfacing material mined in Leyte, was used in much of the construction.

Progress on the rehabilitation program has been excellent in view of the many unforeseen difficulties which have arisen since the work was started in 1946. Active guerrilla warfare between the Huks and Government troops has made it difficult for contractors to operate efficiently in many areas. The situation has improved considerably in the last few months, however, due to a more aggressive campaign by the Philippine Army.

Shortages of badly needed spare parts, particularly tires, have kept much-needed equipment out of commission. Still another cause of delay has been the shortage of portland cement. The shortage is due primarily to the increased demand for cement, particularly by the United States agencies in the development of military bases, and to the lack of shipping space. Arrangements are being made by the Philippine Government to purchase additional cement from Japan to ease the shortage and it has been agreed that rehabilitation projects will receive priority.

With all funds obligated and under agreement by the end of the fiscal year, the remainder of the work of the Bureau's Philippine division will be the liquidation of projects. Both American and Filipino personnel employed by the division were reduced appreciably during the last few months. Only 16 Americans remained at the close of the year.

In addition to the rehabilitation work, the Bureau has accepted responsibility for a Philippine highway development program under the auspices of the Economic Cooperation Administration, which has already set aside $3 million for the development of roads in backward areas.

Aid to Turkey in Highway Improvement

Bureau activities in Turkey, begun in December 1947 at the request of the Turkish Government, are administered through a division office in Ankara. The character of the joint efforts of the Bureau and the Turkish Directorate of Highways has gradually changed as requirements of the program have shifted from organizational and personnel-training activities to those associated with normal operating procedures of a highway department patterned after the best practices in the United States.

The Turkish program, with Bureau advice and counsel, came into being under formal agreements executed by the United States and the Turkish Governments in 1947 and 1948. Funds for supplying equipment and technical assistance have been provided, first by allocation of $5 million under Public Law No. 75, Eightieth Congress, and later by Economic Cooperation Administration loans totaling $18.5 million of which $4.5 million were authorized during the fiscal year. Funds for operation of the equipment and for other highway activities are being provided each year by the Turkish Government. Such expenditures during the Turkish fiscal year, ending March 1, were equivalent to $22.2 million. Delivery in Turkey of highway equipment and tools now amounts to 15,400 tons valued at $12.5 million.

Personnel training, an essential activity at the beginning of the program, remains undiminished in importance. However, with the arrival of construction machinery in substantial quantities, personnel training now shares attention with such operational activities as the survey, design, construction, and maintenance of highways and the establishment and management of equipment repair shops. Methods of personnel training have changed, principally by substitution of on-the-job methods for theoretical classroom instruction. The total number of individuals trained in formal courses now amounts to 1,736 persons, of whom 386 received training during the year.

The organization and management of highway survey and design activities have been improved as the Turkish engineers engaged in these fields have gained further experience in the application of modern methods. An average of 31 location survey parties were in the field during the year, with work concentrated in southern areas during winter months. Completed highway location surveys on the 15,200-mile national system amount to 1,542 miles, with design and plans completed for 574 miles of highway.

Noteworthy strides have been made in equipping and training the construction and maintenance forces of the Turkish Directorate of Highways. At the close of the year 9,750 miles of the Turkish national highway system were under machine maintenance. The 3,770-mile remainder of that system was being maintained by traditional hand-labor methods. Construction forces of the Directorate improved 530 miles of highway by grading as needed and by gravel surfacing, and laid 180 miles of asphalt surface during the year. At the close of the year construction was in progress on 610 miles of gravel-surfaced roads, and 340 miles of asphalt roads were partially completed.

Progress has been made in the attempt to establish a highway contracting industry and obtain the advantages of competitive bidding and efficient management characteristic of the system. During the year 109 miles of highway were constructed by contract, at a cost of $1.34 million. Contracts were in force at the close of the year for construction of 166 miles of highway to cost $4.28 million.

Construction of bridges by machine methods has been encouraged in order to attain a construction rate such that the bridge program will move forward as rapidly as the highway program. This objective has not yet been attained, but progress was made. During the year the bridges completed by modern methods aggregated 0.7 mile in length, but a greater length of bridges was built by hand methods.

Notable strides were made in expanding facilities and improving operating techniques in equipment-repair shops. There are now 10 major shops, one at each highway division headquarters. These division shops are equipped to perform all classes of equipment repairs. At strategic locations within each highway division, there are smaller shops well tooled and equipped to perform the most frequently needed repair jobs.

Basic information needed to guide the Directorate of Highways in its work is being collected and analyzed. Procedures are much the same as those used in the United States in the highway planning surveys that are now routine functions of the State highway departments. Progress is being made in the use of factual data in developing long- and short-range construction programs.

After 3 years of technical assistance to the Turkish Directorate of Highways, more pronounced evidences of benefit begin to appear. With increasing freedom to travel in comfort and with some assurance of arrival at destinations, vehicles are becoming more numerous on the highways. A portion of the travel is recreational in character. There is a public demand for facilities such as hotels and restaurants. Encouragement of a tourist industry by government agencies has now reached an active stage.

Remarkable reductions have been made in travel time and in bus and freight rates to important points on the five main roads radiating out of Ankara. Between Ankara and Istanbul, travel time has decreased from 18 hours in 1949 to 14 hours in 1951, while freight and passenger rates have been reduced 62 percent and 33 percent respectively. Travel time from Ankara to Kayseri has been shortened from 11 to 9 hours, with declines of 33 and 30 percent in freight and bus rates. Travel between Ankara and Zonguldak has been shortened from 14 to 9 hours with 40 percent savings in freight rates and 66 percent in passenger rates. The figures quoted are indicative of nation-wide benefits now realized as a result of the highway program.

The benefits are not confined to motor transport. A peasant donkey driver expressed gratitude for highway improvement, saying that in the days of rough and muddy roads his donkey carried only 44 pounds but could now carry a 66-pound load.

Other Foreign Activities

Ethiopia

In August 1950 the International Bank for Reconstruction and Development requested the Bureau to assist in administering a projected $5 million loan to the Empire of Ethiopia for rehabilitation and development of that country's highways. In response thereto a preliminary advisory mission was dispatched in October 1950, using funds transferred to the Bureau from the International Bank. The mission's report, submitted in January 1951, became the basis for approval of the loan and the establishment of the program of work to be undertaken.

Agreements between the Department of State, Ethiopia, the International Bank, and the Bureau resulted in creating a 3-year advisory mission of Bureau technical personnel to supervise equipping, training, and organizing an Ethiopian Imperial Highway Authority and directing it in the work of restoring the Ethiopian highway system. This system, largely initiated by the Italians, had fallen into serious disrepair for lack of maintenance during the last several years.

At the close of the fiscal year a 40-man staff had been organized, and 26 employees were already in or enroute to Ethiopia; $2 million of needed equipment had been ordered and about half of it delivered; and a program of road improvement was actively in progress.

Liberia

The United States has been cooperating with Liberia in developing a broad program of improvements for that country. Prominently included in the scheme is the development of a planned system of highways and improvement of the small existing mileage. The program is to be administered under the provisions of the Point Four act.

A preliminary investigation to develop the highway portion of this program was under way at the end of the year, with one Bureau engineer already in Liberia. It is planned to establish a mission from the Bureau during the coming fiscal year, to supervise a $5 million road program financed with Liberian funds and an Export-Import Bank loan.

Iran

During January and February of 1951 a three-man mission of Bureau engineers investigated conditions in Iran and recommended an organization and plan of work for a projected highway program. This investigation was made in response to a Department of State request in connection with a proposed Export-Import Bank loan to that country. There has been no activity on this project since submission of the report.

Point Four program

Assistance programs in various phases of highway development were actively being developed, under authority of the Point Four program, in India, Iraq, Pakistan, and Israel, and programs were being discussed by the United States and other interested countries. A Bureau engineer had been assigned to the Israel program for preliminary organizational purposes at the close of the fiscal year. None of the other programs had progressed to the point of assigning personnel.

The Point Four program in general was developing rather slowly because of the complexities of arriving at agreements as to the type of highway assistance that was needed and could be efficiently rendered, and because of the time required for processing of employees for these assignments due to certain legal requirements contained in the basic act itself.

Foreign Visitors

During the year the Bureau assisted well over 200 engineers and other highway officials of more than 40 countries in studies of American highway practice. Many of the visitors remained for only a few hours, but others attended the 1950 and 1951 highway engineering courses, or were here for a full year of on-the-job training with various State highway departments.

The previous report described the 1950 course, which was completed during this fiscal year. The 1951 course, which opened on May 21 and ends on September 7, follows the same general pattern. Forty-nine delegates from 26 countries are participating this year.

The Bureau has cooperated with various State highway departments and the Economic Cooperation Administration in providing a year of practical training in several specialized phases of highway activity for 24 engineers from Turkey. The year also marked the beginning of the Bureau's formal participation in the Point Four program. Five engineers started training under the auspices of this program during the year, and awards were granted to a number of others who will start training during the next fiscal year.

The President's Highway Safety Conference

Personnel of the Bureau continue to assist in the work of the President's Highway Safety Conference under the direction of the Commissioner of Public Roads, who serves as chairman of the conference coordinating committee and of the committee on conference reports.

The fourth major national meeting of the conference since its organization in 1946 was held in Washington near the close of the fiscal year. The governors of the States sent official delegates, and hundreds of city and local officials also participated.

The 1951 session emphasized the *how* of applying the action program for traffic safety, which was originally developed in 1946 and revised in 1949, and reviewed the annual conference inventory of advances and weaknesses in highway safety. The inventory indicated that the seriousness of the traffic safety problem has been increasing as unprecedented numbers of vehicles have been registered for use on the highways and as the volume of traffic has mounted since the close of World War II. The total of 35,000 people killed in traffic in 1950 has not been equaled since 1941. Yet, with preventive activity under the action program of the conference, the rate of fatalities has declined from an average of 12 deaths per 100 million vehicle-miles of travel in the decade 1936–45 to 7.5 in 1950.

In connection with conference activities, the President has said that the " * * * need for a strong America [makes traffic safety] doubly urgent * * * . The defense effort depends upon the efficient movement of goods and people over public highways and roadways."

Roadside Development

During the year the Bureau assisted highway departments and universities in conducting short courses on roadside development in a number of States. Regional conferences between members of State highway departments and the Bureau staff were a feature of these sessions.

Bureau representatives on committees on roadside development of the Highway Research Board and of the American Association of State Highway Officials assisted in preparing and publishing reports on roadside grading and cross-section design and on the design of parking turn-outs and rest areas. These reports describe the latest types of roadside improvement in use by State highway departments in all parts of the country. Plant material lists for roadside planting and erosion control work in each administrative division of the Bureau were assembled for use by the States.

Highway Transport Research

Research on many phases of highway transport is conducted by the headquarters organization of the Bureau and also in cooperation with the States as Federal-aid projects. A large portion of the work at headquarters is based on data supplied by the States.

Road inventory and mapping

Basic elements in measuring highway needs and in planning highways are accurate highway transportation maps and statistics on the extent, surface types, and widths of roads and streets. During the past year 36 States and Puerto Rico continued revision of their inventory of rural roads, bridges, and roadside features. Work was completed in three States and in Puerto Rico, making a total of seven States in which inventory statistics have been revised since the end of the war. The complementary work of revising maps to show current conditions resulted in complete redrafting or revision of maps for 278 counties in 31 States. Revisions of five State maps were also completed. In addition to the usual features covered in an inventory of all rural roads, surveys of critical sight distances on the principal rural roads were in process or completed in eight States. The inventory of city streets continued throughout the year in a number of States, resulting in more accurate urban mileage statistics and better maps of cities and smaller incorporated places. Maps for 1,085 cities have now been made as a part of this activity.

Tourist studies

Highway transportation is of ever-increasing importance in our economy and social life, but efforts to evaluate this importance on some economic basis have invariably failed to give an acceptable measure of the full value of highway transportation because it cannot be entirely gaged in tangible units. Nevertheless, we should do our best to appraise all benefits, tangible or intangible.

One evidence of the importance of highways is the great amount of tourist travel. The cultural benefits to the American public of opportunity to travel, to see different parts of the country, to talk with people from different localities and to learn their thoughts and customs, are immeasurable. The tourist business additionally has a tremendous economic value.

Until a few years ago, reliable information concerning the nature and extent of tourist travel and expenditures was lacking. Such studies as were made were generally fragmentary in nature. In recent years the Bureau has encouraged the making of tourist studies, carefully controlled by relating the data to traffic counts at the State borders or particular areas so that the sample information could be correctly expanded.

In 1950 the Bureau cooperated with the States in conducting tourist studies in Arkansas, Oregon, Washington, Yellowstone National Park in Wyoming, and the Black Hills area in South Dakota. Similar studies were made previously in Arizona, Utah, Idaho, Montana, New Mexico, Virginia, and the Great Smoky Mountains National Park in Tennessee. Numerous other States have indicated their desire to conduct studies of this character. Pennsylvania is inaugurating such a study and Ohio and New York are considering tourist surveys. The States are particularly interested in knowing the income derived from highway travel.

Toll road studies

The Bureau is studying toll road developments throughout the country and in some instances participating in cooperative studies of traffic usage. Studies of traffic on roads to be paralleled by toll highways were started in 1947 in Maine and in 1948 in New Hampshire and have been continued to obtain comparable traffic information after completion of the toll roads. A comparison of "before and after" data reveals the amount and kind of traffic which shifts to the new facility and the amount and kind of new traffic on both the old and new facilities.

Similar studies are being made on the east and west extensions of the Pennsylvania Turnpike and in Ohio between the Pennsylvania State line and Cleveland, in cooperation with the respective State highway departments.

Traffic volumes

Traffic on rural roads reached an all-time high in the 1950 calendar year, increasing over that of the previous year for the seventh consecutive year. Total traffic was almost 9 percent above that for 1949 and 137 percent above that for 1943, the wartime low. The 1950 estimates are based on records obtained at 983 continuously operated traffic counting locations, an increase of 83 over 1949. Locations on both main and local roads are represented.

Because of the increased problems in the planning of urban highways, effort has been made to obtain more counts of traffic in cities. Based on counts made in 33 cities (11 more than in 1949) it is estimated that travel in urban areas is 6 percent greater than in 1949 and 103 percent greater than in 1943.

Truck weights

The tonnage of goods carried by trucks, the frequency of truck movements, and the size of loads carried are important indications of highway service. Each year operations are scheduled to obtain this information by weighing commercial vehicles at selected locations. During the fiscal year 45 States participated in this program and vehicle weights were obtained at more than 500 locations. Comparison of data obtained with that of previous years permits the calculation of trends in vehicle loading and in frequencies of heavy loads.

Preliminary analysis of the 1950 data indicates that truck traffic increased more than passenger traffic, that a larger proportion of the trucks were loaded, and that the average load was materially heavier than in previous years. The cumulative effect of these factors was that the ton-mileage of carried load increased much more rapidly than the vehicle-mileage of traffic in general. It is estimated that the ton-mileage hauled in 1950 was more than one-third greater than in 1949, compared to an increase of 9 percent for the vehicle-mileage of travel by all vehicles.

Rural travel and road usage

Preliminary conclusions have been reached in a study of rural road usage in Charlotte County, Va., to determine the effects on highway travel of the establishment of a manufacturing industry in an area previously entirely agricultural in character. As the standard of living increases, when measured by such factors as type of house, size of family in relation to number of rooms, modern conveniences, and vehicle ownership, there is an increase of motor-vehicle travel and a demand for improved highway facilities. In this area daily transportation to and from work is entirely by highway and it is significant that few of the 300 persons employed in the new plant have changed their places of residence.

A new industrial plant may require some changes in the location of roads in a rural county, but this influence is closely interwoven with other influences, such as increased or decreased marketing of forest, farm, and mineral products, changing tourist traffic, and changing merchandising services that go along with increased or decreased family incomes. The pattern of traffic generated by new industries will be superimposed on a road system already developed for the other patterns, increasing the demand for adequately maintained surfaces and in many instances for the construction of a higher type of highway.

City surveys

Planning based on reliable origin and destination information and other pertinent facts concerning travel in urban areas has become a widely accepted principle in the location and design of new urban arterial routes. Emphasis is placed on the need for use of factual data in planning by the ever-increasing traffic and congestion in urban areas and the concentrated efforts being made to improve existing conditions.

To collect essential facts, comprehensive metropolitan area transportation studies by the home-interview method were developed in 1944 and, since that time, such studies have been made in 89 metropolitan areas in 35 States. Four were started during the fiscal year. Origin and destination traffic studies were undertaken by abbreviated methods in a number of the smaller cities and several more such studies were about to begin.

Study of travel on superior arterial routes in urban areas was initiated in 1950 and is being continued as new arterial routes are placed in operation. Analysis of the trip data collected in four different cities shows that a considerable number of drivers choose a superior facility in going from one point to another even though the trip requires both added travel time and added distance. Preliminary results indicate that, when travel time is the same by either route, approximately 50 percent of the drivers choose the superior facility even though the distance is greater than it would be by an alternate, less-attractive route. When both time and distance are saved, the percentage of drivers that choose the superior facility approaches 95 to 100 percent. Additional studies must be made in other cities and on facilities of varying design and attractiveness before more comprehensive and definite conclusions can be reached.

Parking and terminal facilities

Facts about parking conditions in congested downtown urban areas have been obtained from studies made cooperatively with State highway departments and city authorities in 77 cities in 30 different States. These facts on present usage of parking facilities, when compared with traffic volumes used in planning expressway and arterial street improvements serving the same area, demonstrate the need for planning parking improvements to meet the demand to be expected when major arteries are built. In cities of less than 50,000 population, where traffic volumes are relatively small and where private enterprise cannot see a profit in the parking business, cities and individual merchants have been forced to provide parking facilities. Bus service in cities of this size is seldom adequate and people depend on private automobiles for transportation. In larger cities the lack of an agency or department with clearly defined authority and responsibility for developing and administering parking programs is a major cause of delay in reducing parking congestion.

Although the studies thus far have been directed toward downtown problems, there is a growing realization that criteria must be established for use in the planning and development of the outlying and suburban community shopping areas and their essential parking facilities. Appropriate recognition must be given to areas of retail trading influence and to the arterial highway development.

Weighing vehicles in motion

A knowledge of the actual weight of commercial vehicles as they are operated over the Nation's highways and of the frequency of heavy axle loads is necessary in the regulation of vehicles and in design of highway surfaces and bridges. Information is also necessary to determine the tonnage of freight hauled by trucks and the trend in the total weights and axle weights of individual trucks of different types and axle arrangements.

The Bureau has cooperated with State highway departments in obtaining information by conducting periodic surveys. Trucks are stopped and weighed either on portable loadometer scales or on platform scales. The number of vehicles weighed has been limited because of the cost of the operation and the inconvenience to truck operators.

During the past 4 months an electronic scale has been developed by the Bureau, working in cooperation with manufacturers of electrical equipment. The device measures and records the weights of trucks as they travel on the highway at their normal speeds. The speed of the truck, the weight on each axle, and the distance between axles is recorded without interfering with the normal flow of traffic.

Testing of the device is still under way but it is already indicated that the weight of a vehicle in motion can be obtained with a high degree of accuracy. If the early indications are confirmed by the more exhaustive tests now in progress, the instrument will provide the means of obtaining a great amount of needed statistical information at low cost. It will also provide a means of detecting overweight vehicles, which are causing abnormal damage to highway surfaces, without delaying other vehicles. This should result in better enforcement of legal load limits.

Highway capacity

During the year many cities and States have benefited by the information contained in the *Highway Capacity Manual*, published near the beginning of the fiscal year. Preliminary plans have been revamped, eliminating potential bottlenecks at some locations and economizing at other locations where it was found that a less extensive plan would satisfy traffic requirements. A study of the preliminary plans for an expressway in one of our largest cities revealed that the traffic for which the main body of the expressway was designed could neither find access to nor egress from the through traffic lanes because of restrictions imposed by faulty connecting ramps, ramp terminals, and weaving areas. Revision of plans to conform with capacity requirements is certain to result in a design that will permit the expressway to function properly and serve its intended purpose.

Traffic bottlenecks, once they become a reality, are simple to detect but costly to eliminate. To be able to detect them prior to construction, which is now possible, marks a great advance in highway economy since correction is now largely a matter of redesign rather than of reconstruction.

Motor-vehicle performance

The manner in which passenger cars and commercial vehicles perform on the highway is of utmost importance to highway engineers and administrators. The Bureau has conducted extensive tests to evaluate motor-vehicle performance. Vehicle performance is a broad term, but to the highway engineer it means the ability to ascend and descend grades, to stop within certain limits, to go around curves of various degrees of sharpness, and to increase speed on level grades. It also includes the performance of a vehicle in terms of fuel consumption, tire wear, travel time, and maintenance.

Research has been aimed at three principal goals: Development of highway facilities that harmonize with the performance of vehicles; formulation of practical regulatory measures that will insure safety and yet not cause economic hardships to highway users; and determination of the proper economic relation between the cost of providing highway facilities and the cost of operating the vehicles that use them.

Research projects have been initiated to determine for vehicles of various types:

1. The hill-climbing, down-grade, and level-road ability in terms of speed, weight, and power.
2. The forces that oppose the motion of motor vehicles, such as friction between tires and road surface, friction between the moving parts of the vehicle, and resistance of air.
3. The braking ability in terms of vehicle stopping distance.
4. The turning ability in terms of off-tracking or turning width and radius of curvature.
5. The direct operating cost factors of motortrucks.

Work during the past year has been largely concentrated on the development of a formula for predicting the hill-climbing and level-road ability of commercial vehicles, the determination of the braking ability of all types of vehicles, and the determination of the actual operating relation between the weight of commercial vehicles and the engine horsepower.

Assistance has been given a committee of the Society of Automotive Engineers in developing a procedure for predicting truck ability on grades and level roads. The project is nearing a successful conclusion and it is now possible to compute performance with a reasonable degree of accuracy. The Bureau has contributed formulas for the forces that oppose the motion of a vehicle and has checked the results obtained against the results of actual tests. It appears that an average difference between the computed and actual ability of 5 to 10 percent can be expected. Costly road tests will no longer be necessary in many instances because of the development of this prediction procedure.

Brake research

In 1941 the Bureau undertook an extensive study of the performance of brakes in cooperation with the highway transport industry. It had the assistance of a committee composed of representatives of 20 interests connected with highway transport: 4 in the Government and 16 others.

The research has been divided into three phases: Tests on vehicles in service, selected at random from the general traffic; controlled tests on new commercial vehicles; and controlled tests on used commercial vehicles.

Tests in the first and third phases were made by the Bureau and those in the second phase by the Brake Technical Committee of the Automobile Manufacturers Association. The project was interrupted by the war. At that time only the first phase had been completed. After the war it was necessary to repeat these tests in three locations—Maryland, Michigan, and California. The field work for all the phases was completed during the past year.

Minimum hill-climbing requirement

A legal requirement that a truck must be able to maintain a specified minimum speed on a grade of a given slope has often been advanced with the idea of eliminating the congestion that results from slow-moving trucks on hills. Studies conducted by the Bureau have shown the futility of attempting to legislate and enforce a minimum performance requirement to eliminate congestion. Solution of the problem appears to lie in the field of highway design. It is indicated, however, that a requirement fixing a relation between net engine horsepower and gross weight of vehicle is desirable. Such a requirement, since it would involve vehicle design, would also result in better balance between the weight of a vehicle and the capabilities of its brakes, tires, and other component parts. This better balance should result in safer vehicles on our highways.

A special study was initiated this year to obtain data on the weight and horsepower of vehicles as operated in everyday traffic. One weighing station located on a major trucking route was operated in almost every State. The data obtained are being analyzed to show what impact any recommended requirement would have on the industry.

Financial and Administrative Research

Work under this general heading includes studies of highway costs, administration and management, land acquisition, highway access and roadside control, terminal facilities, finance and taxation, and allied economic problems. During the past year progress was made in all of these fields of study.

Finance and taxation

All of the States regularly report to the Bureau data on motor-vehicle registrations and receipts, motor-fuel consumption and taxation, State highway income, expenditures, and debt, State highway mileage existing and built, and allied subjects. Although the reporting of highway data for counties and municipalities is much less complete, more than 40 States now supply reports of county and local rural road income, expenditures, and debt. A majority of the States are also supplying data on the highway finances of urban places. The analysis and compilation of the State, county, and local data, and the publication of statistical tables and reports based upon them, result in a substantial contribution to research in the field of highway finance.

Continued assistance was given to States engaged in studies of highway financing problems. Work in this field included the preparation and distribution among the States of a report on the problem of allocating motor-vehicle tax responsibility among vehicles of different types and sizes. Field visits were made to supply assistance in the conduct and development of highway finance and tax studies. In response to a request from one State, a statement was prepared discussing the recent experience of other States in the bond-issue financing of highways. For another State the validity and soundness of a proposal for the credit financing of State highway improvements was tested in a series of calculations. Further assistance was rendered by the review of State reports prior to their publication.

Much of the research in this field is in cooperation with committees of the Highway Research Board and the American Association of State Highway Officials. At the request of the Committee on Highway Taxation and Finance of the former, a selected bibliography on highway finance was compiled and published during the year. The Special Subcommittee for Study of Highway Finance Problems of the Association has the responsibility of maintaining current an inventory of improvement needs of the Federal-aid systems. The Bureau is actively cooperating in this work.

Motor-vehicle use studies

A new series of motor-vehicle use studies, designed to yield information about the characteristics of postwar motor-vehicle travel, was inaugurated shortly before the close of the fiscal year. Road-use surveys, conducted during the period 1935–40 in a large number of States, revealed the pattern of prewar travel. More recently numerous cities, with State and Bureau cooperation, have conducted origin-destination surveys in which the special characteristics of urban travel were studied. The new surveys follow the style of the earlier road-use studies, in that they are State-wide in scope and are designed to classify motor vehicles and their travel with respect to rural or urban location and size of urban place, as well as by road system and purpose of travel. The technique, however, is similar in many respects to that of the home-interview urban origin-destination studies.

At the close of the fiscal year motor-vehicle use studies had been started in two States, and negotiations were under way in several others. The Bureau assists in the organization of these studies, and provides guidance in the interest of uniformity among the States.

Study of road usage and condition

A series of studies was initiated in 1950 to evaluate the performance of selected road sections. These studies will extend over a period of several years, with the objective of obtaining a continuing record of road condition, performance, and costs, and their relation to the traffic volumes and weights of vehicles using the roads. Detailed information is being obtained on roadway structures, condition, and costs, and on traffic characteristics, for correlation and comparison. Evaluation of the performance of the selected road sections is in terms of roughness, occurrence of cracks, and other signs of pavement fatigue in relation to frequencies of heavy loads, volumes of traffic, and costs.

During the past year approximately 425 test sections in 37 States have been selected for study. Most of these test sections are at locations where traffic counts and weight studies have been made in previous years. New schedules for counting vehicles and weighing trucks are being placed in operation at all of the selected locations. These schedules include seasonal operations as well as increased daily coverage. During the past year construction and maintenance cost data have been obtained from 16 States for 182 of the test sections. Annual road cost analyses have been completed for 38 of the test sections and partially completed for 70 others.

Highway costs

Every highway generates a demand for rebuilding, modernization, maintenance, and operation. Many facts are needed in order that such demands may be met effectively, among which are data relating to the costs of highways.

Highway cost studies were continued during the year in cooperation with the State highway departments. These studies relate to construction and maintenance costs, service lives, and the required rates of replacement of the various types of surfaces.

A pilot study was carried out during the year, in cooperation with the Kentucky Department of Highways, of the annual cost of a series of highway control sections comprising a continuous route 210 miles in length.

Assistance was given to three States—North Dakota, Ohio, and Virginia—for which long-range highway needs studies were being made by the Automotive Safety Foundation, and to Colorado, which made its own study. The assistance included extensive applications of road life and annual-cost information in setting up a replacement program, adjusting the program for predicted annual changes in revenue and price levels, and calculating the annual costs of bringing the several highway and street systems up to adequacy for varying program periods.

In the Virginia study, efforts were concentrated on overcoming those deficiencies which are most serious from the standpoint of national defense and essential civilian traffic in the present emergency.

During the year assistance was given to two State highway departments in setting up control sections on their primary highway systems, and to several States in reviewing procedures and methods for reporting maintenance and operation costs by control sections. It has become increasingly evident that there should be a common basis for keeping records of costs. The control section procedure is now generally accepted as the most convenient means for the assembly of highway data in a form suitable for analysis and correlation. Control sections have been set up in approximately one-third of the States since this work was undertaken in 1946.

Production cost studies

The underlying purpose of all production cost studies is reduction of unit costs in highway work. This objective can be attained only through increased efficiency of construction and maintenance operations. The work in this field done by the Bureau consists largely of time studies of equipment and labor performance on various construction and maintenance operations, in an effort to determine those delays which may be eliminated or operating procedures which should be changed, thus increasing efficiency and ultimately lowering costs.

Studies of equipment performance were conducted on 34 construction projects throughout the country. The 1-year study in Connecticut of equipment utilization and performance in State highway maintenance was continued through the year, following preliminary pilot studies started during 1950. Shorter studies of equipment utilization and performance on State highway maintenance were conducted in four States.

Studies of the operation of a soil stabilization machine showed that 8-foot sections of a roadway can be processed at an average rate of 1,472 feet per hour, exclusive of all delays, maneuvers, and turns. When an allowance is made for the two items of turning and maneuvering the rate is reduced to 1,340 feet.

Highway administration

Work in this field was carried on chiefly in cooperation with the Committee on Highway Organization and Administration of the Highway Research Board. Attention was centered during the year on a comprehensive study of personnel practices among the State highway departments. A progress report on this study was presented at the annual meeting of the Board. Detailed reports are being prepared on hours of work, overtime, vacation, and sick-leave provisions, on retirement provisions, and on merit system provisions in State highway employment.

A preliminary study of the statutory provisions affecting State-local highway relations was completed. The subject matter of this study included general policy, design, planning and budgeting, purchasing, equipment, personnel, and exchange of equipment and services.

A beginning was made in the study of administrative practices in motor-vehicle regulation. Statutory data on penalty provisions for violations of truck weight and size limitations, and on the enforcement thereof, were compiled. A study of the taxation and regulation of motor carriers was also begun.

Land acquisition, roadside control, and terminal facilities

Research in the legal and administrative phases of right-of-way acquirement, roadside protection, and parking facilities was continued.

A report dealing with the right of immediate possession of property needed for highway purposes was completed, in cooperation with the Committee on Right-of-Way of the American Association of State Highway Officials, based upon facts reported to the committee through a questionnaire on State land-acquisition practices.

A special study of highway zoning and roadside protection was completed and published in the March 1951 issue of the *Wisconsin Law Review*. While the study pertained principally to Wisconsin, its findings and conclusions are applicable to most States.

The study of the impact of an expressway on an urban and suburban community, with the Shirley Memorial Highway in Virginia as the subject, was continued during the year. Land-use and land-value changes were recorded and analyzed. A study of similar type has been undertaken by the Texas State Highway Department, in cooperation with the Bureau, of the Gulf Freeway in Houston.

In cooperation with a committee of the Highway Research Board, the Bureau has undertaken a study of procedures available for the reservation of lands for right-of-way prior to their acquisition in the customary manner. These include subdivision regulations, zoning, designation of ultimate right-of-way widths, reservation agreements, easements, administrative measures, etc. Over 60 cities that were known to have used procedures for this purpose were asked to supply information. The answers are being analyzed.

A study has also been initiated of the effectiveness of various types of parking agencies in some of the cities of the United States. A large amount of information on all phases of the parking problem has been gathered, and the data are being studied with the objective of developing desirable principles of administration of off-street parking facilities. The study encompasses, at one extreme, a special ad hoc parking authority having the power of eminent domain and authority to issue revenue bonds and, at the other extreme, a parking commission with advisory powers only.

Cities conducting parking surveys were assisted in solution of the legal, administrative, and financial problems involved in the provision of off-street parking facilities. Progress in a number of cities was notable. A study of parking facilities as public utilities was completed.

Assistance has been rendered in the formulation of administrative policies and legislation designed to regulate land-use development along roadsides, to protect motorists and property owners from the consequences of haphazard development.

Extensive information concerning current legislation, court decisions, and administrative practices relating to control of highway access, highway rightsof-way, roadside areas, and parking facilities has been disseminated through the Highway Research Board.

Hydraulic Research

In the field of hydraulics, effort has been directed primarily toward digesting numerous research reports and developing the application of such data to the solution of problems commonly encountered in highway engineering. The reports being used are those resulting from the work of the Bureau, cooperating agencies, other Federal agencies, and universities.

The desirability of making the latest data available to field engineers has been evidenced by studies of plans for Federal-aid projects. It has been found that some designers were not aware of newly developed information on the hydraulic characteristics of storm-drain inlets and various special structures for handling storm runoff. The field of information in which designers appear to need the most help, however, is in estimating the magnitude of a flood likely to occur on a given watershed.

The need for authoritative data on peak rates of runoff has long been recognized, but only within recent years have records been accumulated for a sufficient number of years to enable reasonably accurate estimation of flood frequencies. The Bureau does not engage in measuring peak rates of rainfall and runoff, since that work normally is done by such agencies as the Weather Bureau and the Geological Survey and, on research projects, by the Soil Conservation Service and the Forest Service. Working with data from all of these sources, progress is being made in establishing significant relations between peak rates of runoff and the size of the drainage area, as well as with a number of other factors involving characteristics of the watershed and of the local climate.

The policy of utilizing the facilities of existing hydraulic laboratories for research on the flow of water through structures commonly used on highways is working satisfactorily. During the fiscal year research projects have been under way at the State University of Iowa, University of Illinois, Oregon State College, and the Rocky Mountain Hydraulic Laboratory.

The basic investigation of the mechanics of scour around bridge piers and abutments is continuing at the Iowa Institute of Hydraulic Research as a Federal-aid project under an agreement with the Iowa State Highway Commission. A progress report was published during the year by the Highway Research Board. Arrangements are now being made to explore the use of electronic instruments for measuring the depth of scour around actual bridge piers during flood stages. Measurements made during normal flow are not sufficiently informative. The experience of the Coast and Geodetic Survey in the use of portable depth recorders will be utilized. This investigation holds promise of eventually developing reliable data to be used in predicting the maximum depth to which scour is likely to extend at any given bridge site. Such information is essential for design to withstand floods without waste of funds.

The Iowa Institute of Hydraulic Research is also conducting for the Bureau a basic investigation on the movement of sediment in pipe lines. Results already obtained indicate that some of the accepted concepts of silting in pipe lines will have to be revised. It is well known that storm drains occasionally become filled up with sediment to the extent that frequent costly cleaning is required. The work at Iowa City is aimed at discovering the basic factors which cause material to be deposited. It is already obvious that where pipe lines must be placed on very flat grades because of the topography it is virtually impossible to prevent silt, sand, and gravel, if brought into a pipe, from being deposited. The alternative then becomes the installation of settling basins which will trap material too large to be moved through the pipe. The design of such basins is also being investigated at Iowa City.

Research on other phases of the flow of water in storm drains, particularly with respect to highways in urban areas, is continuing at the University of Illinois as a Federal-aid project of the Illinois Division of Highways. This project also includes statistical studies on the intensity and frequency of rainfall.

During the summer of 1950 the Rocky Mountain Hydraulic Laboratory cooperated with the Bureau in conducting experiments with models on the use of flexible mats to reduce scour around bridge piers. A report has been published by the Highway Research Board.

Just before the end of the fiscal year a new Federal-aid project began at Oregon State College under an agreement with the Oregon State Highway Commission. Its object is to determine the advantages and limitations of enlarged inlets on box culverts. The need for this investigation has become evident from the observation that culverts on steep grades may flow perhaps only half full despite the fact that water may be ponded at the entrance to such depth that the roadway is overflowed. Enlarged inlets to remedy this situation are being used on forest highways in Oregon but the limits of economical operation need to be established by research.

The Bureau is participating in the work of the Subcommittee on Hydrology of the Federal Inter-Agency River Basin Committee. During the summer of 1950 it assisted in preparing material for consideration by the President's Water Resources Policy Commission, particularly with respect to studies on the adequacy of basic data on rainfall and runoff.

Because of the vast amount of new material which has been developed within recent years on hydraulics and hydrology, there is a great need for training of highway engineers in the application of the new knowledge to drainage design problems. This training is being accomplished gradually through the medium of training manuals and in-service training courses conducted in the field. Highway engineers trained in hydraulics are needed to accelerate this work. That such training is desirable should be evident from the fact that the cost of culverts, bridges, and other drainage structures amounts to approximately 25 percent of the total cost of constructing highways.

The Maryland Road Test

An extensive study to determine the effect of heavy loads on a concrete pavement was started in June 1950 near La Plata, Md. Traffic operations of this test were completed in December but study and tests of the pavement and subgrade continued through the spring months of 1951.

The principal object of the test was to determine the relative effects, on a particular concrete pavement, of four different axle loadings. Information such as was obtained from this experiment is greatly needed for use in appraising the load-carrying capacities of existing concrete pavements, for use in designing new pavements, and to provide fundamental data that may be useful in framing equitable legislation to govern highway transportation.

The test was conducted under the direction of the Highway Research Board as a cooperative project of 11 eastern States, the District of Columbia, the Bureau of Public Roads, the Department of Defense, the truck-manufacturing industry, and the petroleum industry. The Bureau furnished instruments and technical personnel for the conduct of the test and for the field and laboratory work in connection with the soil and concrete analyses and the strain and deflection studies. This investigation demonstrated the benefits of cooperation by a number of diverse agencies in research on a problem of great mutual importance.

The test was conducted on a 1.1-mile section of concrete pavement on U. S. 301 south of La Plata, Md. The pavement consisted of two 12-foot lanes, each having a thickness of 9 inches at each edge and 7 inches at the center and reinforced with wire mesh. The pavement was constructed in 1941, and for 9 years was subjected to the forces of nature and to loadings of comparatively light weight. At the beginning of the test the pavement was remarkably free of visible damage.

The test consisted primarily of determining the relative effects on adjoining lanes of travel by trucks of the same type but with different axle loadings. Two two-axle trucks, each with 18,000 pounds on the rear axle, were operated on one section, and two two-axle trucks, each with 22,400 pounds on the rear axle, were operated on a second test section (the adjacent lane). Two three-axle trucks, each with 32,000 pounds equally divided between the tandem rear axles, and two three-axle trucks, each with 44,800 pounds equally divided between the tandem rear axles, were operated on the third and fourth parallel sections, respectively.

Observations of cracking of the four differently loaded test sections, the settlement of the slabs, the riding quality, and other effects of the traffic on the pavement are being used to evaluate the effects of the several loads. Measurements were made of the strains produced in the pavement by loads of various magnitudes, of the deflection of the slabs under the various loads, of the subgrade condition, and of the quality of the concrete. Tests were made on nearly 1,000 samples of subgrade soil and 150 cores from the pavement to indicate their quality. After completion of the traffic tests, a trench 24 inches wide and 36 inches deep was dug along the edges of all four sections to facilitate the study of the soil condition.

All pertinent data must be carefully analyzed and considered before final conclusions are drawn. However, certain facts have already been established. The more significant observations that may be made from the test results after the completion of the traffic tests (after 6 months of continuous operation) are as follows:

1. Tests on soil samples obtained throughout the length of the pavement adjacent to the pavement edges and under certain sections of the pavement indicate that there is substantial uniformity in the soils on the two sides of the pavement.

2. There is found to be a definite correlation between soil type and pavement behavior. The higher the granular content and the lower the plasticity of the soil, the better the performance. The subgrade soil on this project is typical of the soils underlying a very extensive mileage of concrete pavement throughout the country.

3. The progress of cracking and depression of joints in the test sections has a definite relation to the occurrence of pumping.

4. Based on both tests of quality and measurement of dimensions, the concrete in the test sections is of good strength and of the designed thickness.

5. The sections were damaged by the loads applied as follows:

(*a*) The 44,800-pound tandem-axle loads caused approximately 12 times as much cracking (lineal feet) as the 32,000-pound tandem-axle loads. This relation held true over a period of almost 4 months, that is from 20,000 to 92,000 truck passes in each lane.

(*b*) The 22,400-pound single-axle loads caused approximately six times as much cracking as the 18,000-pound single-axle loads. This relation held true over a period of almost 5 months, that is from 35,000 to 238,000 truck passes in each lane.

(*c*) After 92,000 passes, 93 percent of the joints in the section carrying the 44,800-pound tandem-axle loads were broken and depressed. In the same number of passes, 18 percent of the joints in the section carrying the 32,000-pound tandem-axle loads were broken and depressed.

(*d*) After 238,000 passes, 50 percent of the joints in the section carrying the 22,400-pound single-axle loads were broken and depressed. In the same number of passes, 18 percent of the joints in the section carrying the 18,000-pound single-axle loads were broken and depressed.

(*e*) After 92,000 passes, 96 percent of the slabs in the section carrying the 44,800-pound tandem-axle loads and 27 percent of the slabs in the section carrying the 32,000-pound tandem-axle loads contained cracks which have been analyzed as constituting structural failures due to the application of the test axle loads.

(*f*) After 238,000 passes, 58 percent of the slabs in the section carrying the 22,400-pound single-axle loads and 26 percent of the slabs in the section carrying the 18,000-pound single-axle loads contained cracks which have been analyzed as constituting structural failures due to the application of the test axle loads.

Additional information, which will be of great value to designers of pavements and to those charged with evaluating the load-carrying ability of existing pavements, is being obtained from the analysis of the strains in the pavement under various loads and of the strains induced by warping of the slabs due to temperature differentials between the top and bottom of the concrete.

To obtain complete answers to the many questions involved in the interrelation between loads, pavements, and subgrades, additional test projects under other conditions will be necessary. It is planned to undertake such projects on both bituminous and portland-cement concrete pavements under other typical conditions.

Physical Research

In the determination of the suitability of a material for use in road construction, its quality can be appraised best by considering its service record. Often it is not feasible to determine the behavior of materials in service and the laboratory is charged with the development of methods of test which will quickly indicate their quality. Changes in the type and intensity of traffic as well as changes in the materials used necessitate frequent readjustment of the procedures employed by the laboratory to develop information.

The determinations of the characteristics of materials which were considered adequate at one time may become entirely outmoded by technologic and economic developments. The use of new materials in construction requires a constant surveillance of test procedures and revision of the aims and objectives of research investigations. Consequently, research must be considered as a continuing investigation with the scope constantly changing as construction practices vary and as new materials are offered for use or as new demands for information are presented.

In addition to research, a large volume of routine testing was conducted in connection with Bureau work and for other Government agencies. Some of this work required development of new methods of tests, and the results obtained may be found applicable to research at some later date.

Activity in the work of the various technical and specification-writing authorities and associations which concern themselves with highway materials was continued. Cooperative tests were made to assist in the development work necessary to revise specifications for several different types of materials. In connection with the work of the Committee on Materials of the American Association of State Highway Officials, a study of the reliability of certain methods of testing materials was continued and the results reported. It is expected that the findings of this study will be instrumental in the attainment of more uniform results among different laboratories engaged in testing highway materials.

Soil studies

Marked progress has been made in studying the nature and properties of soil clays, and their suitability for use as subgrade materials for highways. This work is based on the knowledge that the quantity and quality of clay in soils are of prime importance in the design, construction, and maintenance of highways and associated structures. The active constituents of soil clays are minerals composed of hydrous aluminum silicates and known as the basic clay minerals. Work has been started on identification and quantitative estimation of the clay minerals, using the electron microscope, the X-ray diffraction method, and differential thermal analysis techniques.

An exploratory study using the electron microscope for the examination of soil clays has been completed and a report of the findings is being prepared. A recording type X-ray diffraction apparatus containing a Geiger counter has been purchased and is being assembled for use in these studies. Specifications for a differential thermal analysis apparatus have been completed and the equipment ordered. The X-ray and thermal techniques are a part of the overall program of research on the physical and chemical properties of the soil-clay constituents.

The laboratory study of chemical deflocculating agents in the hydrometer analyses of soils has been completed.

Studies of the permeability and drainage properties of sands and soil-aggregate mixtures have been finished. This work included the development of several types of apparatus for measuring permeability, the determination of the permeability of a number of soil-aggregate mixtures in which the character and quantity of the fraction passing the No. 200 mesh sieve were varied, and the measurement of the time required for the maximum drainage of these materials under laboratory conditions.

A report has been completed which shows close agreement between observed and computed settlements of abutments of three bridges and one embankment along the Potomac River near Washington, D. C. The computed settlements were based on results of consolidation tests on undisturbed samples taken from borings at the various sites. The study demonstrates the possibility of making a reasonably accurate estimate of the settlement of a bridge pier or embankment from test data obtained on undisturbed samples taken from the foundation soils prior to construction.

A laboratory investigation of the use of electrical cells consisting of stainless-steel resistance elements enclosed in nylon or fiber glass for the measurement of the moisture content of soils in subgrades and embankments is nearing completion. The electrical resistance of the unit changes with variation of the moisture content of the soil. A calibration curve over a range of moisture must be obtained for each soil, and in the past a satisfactory method of calibrating the cells has not been available. Such a method has been devised and is being used successfully in measurement of moisture in the subgrade of the Hybla Valley test track.

In an effort to develop further usage of local materials in the construction of secondary roads, a laboratory investigation of typical shales from West Virginia has been completed. Freezing and thawing, wetting and drying, plasticity, and volume-change tests have been made and an effort will be made to correlate the results with road performance.

Field observations of the cooperative experimental concrete pavement in Indiana, designed to study pumping, have been continued. Construction, test, and traffic data are being analyzed.

In cooperation with the Ohio Department of Highways, a location has been selected, plans and specifications prepared, and a contract awarded for an experimental concrete pavement designed to test various methods of preventing mud pumping at joints and cracks. The subgrade is a silty clay susceptible to pumping. Sections of concrete pavement will be placed directly on the natural soil and on subbases 3, 5, and 8 inches thick. The subbases will be composed of both pervious and relatively impervious materials and soil-cement mixtures. In addition to observations of pumping, periodic determinations will be made of moisture contents and densities of the subgrade soils and base courses.

Progress has been made in developing methods suitable for the preparation of engineering soil and drainage maps on an area basis. In cooperation with the Maine, New Jersey, and Virginia State highway departments, research on mapping projects has been continued. In Maine, the preliminary engineering soil and drainage mapping of the second trial area of 1,000 square miles has been completed and work has been started on a third area of approximately 400 square miles. Two reports on the New Jersey soils survey have been published. One is a general engineering soils bulletin for the entire State. The other is an engineering soil report and map for Essex County. Preliminary engineering soil reports and maps have been completed for five other counties, and mapping and testing of soils have been started in another four counties. These reports and maps describe methods developed for the interpretation of aerial photographs and show the distribution of soils likely to require similar treatment from an engineering standpoint.

A research project on the preparation of an engineering soil and drainage strip map for a portion of the Natchez Trace Parkway in Alabama was completed. A report soon to be published describes the methods developed and used in making the maps.

Bituminous materials and mixtures

The study of bituminous materials and their uses is an important feature in the design of pavements which will be capable of withstanding the ever-increasing demands of traffic.

This work includes (1) continuous study of bituminous materials to correlate known test properties with service behavior, (2) determination of the properties, merits, and limitations of new materials, (3) study of the properties of aggregates that affect their behavior in service, (4) design of combinations of materials that will be satisfactory for different service conditions and will utilize local aggregates to the greatest possible extent, and (5) improvement in and development of new methods of tests to provide a basis for the acceptance of satisfactory materials and combinations thereof and for the rejection of those that are unsuitable. A variety of field and laboratory studies have been and are being carried on, of which the following current investigations are typical.

During the past year some unsatisfactory results were obtained with tar prime application on base courses in several of the southern States, although the materials met all existing specification requirements. The exceptionally slow curing of these materials and the tendency for the light tar fraction to separate from the heavier portion before complete penetration into the base caused delay in construction in some instances and in other instances resulted in unsatisfactory construction. To prevent use of materials having these objectionable characteristics a number of new tests, as well as the narrowing of specification limits, were tried. It was found that a reduction of the maximum limit in the sulfonation requirement eliminated tars containing very high percentages of paraffinic and naphthenic hydrocarbons which were found to be the cause of the unsatisfactory behavior. Approval of this change in specifications was recommended.

Interest in the use of rubber in bituminous construction is increasing and a number of experimental pavement sections containing rubber have been built. In addition to those previously constructed in Virginia, Ohio, and Texas, a number of sections were built during the late summer and fall of 1950 in Massachusetts. The construction of these latter sections was observed by representatives of the Bureau. A number of natural and synthetic rubbers were used. Conclusions are not yet warranted on the skid-resistant properties or lower maintenance costs of pavements containing rubber, which are the chief benefits claimed, nor has the effect of different rubbers on the properties of asphalts been established.

Laboratory investigation of rubber-asphalt blends shows that the effects of different rubbers on the characteristics of a given asphalt, or of a given rubber on different asphalts, vary widely. The information presently being developed should prove of value in determining whether the character of the pavement will be improved by the alteration of properties of the asphalt through the addition of rubber.

Studies to determine the benefits of chemical additives in improving the adhesion of asphaltic materials to aggregates in the presence of moisture have been continued. Laboratory tests indicate that the effectiveness of the additive varies with asphalts from different sources but is not affected by different consistencies of a given asphalt. The necessity for the use of additives with asphalt cements in hot bituminous mixtures has not been established and is still under investigation. New additives produced in Europe, for marketing there and in this country, appear by laboratory test to be similar in behavior to those of domestic production.

Cooperative studies of bituminous concrete in Virginia and Maryland are being continued, and one in Delaware was recently begun. In addition, a comprehensive study of materials and types of bituminous concrete construction in the Rocky Mountain area is being planned. Bituminous concrete will be used to replace the road-mix type of surface which is not considered adequate for present traffic. Studies of special local materials proposed for use in bituminous mixtures continue. One such study is that of Guatemala sand for use on the Inter-American Highway.

Examination of current test methods and the search for methods more practical in operation or application are being continued. The immersion-compression test, now being used by several State highway departments, has been accepted as a standard by the American Society for Testing Materials for determining the detrimental effect of water on compacted bituminous mixtures. The triaxial compression test, which is gaining favor as a research tool for evaluating the stability of granular and granular-plastic materials, is being applied to the study of bituminous mixtures. By test of cores taken from bituminous pavements as well as molded specimens, it is hoped that a correlation between the results obtained with the triaxial compression test and field behavior will be obtained.

Other examples of the application of new equipment or a new approach to developing information are the use of a flame photometer for determining sodium and potassium in soils and other siliceous materials, the development of an improved method of test for free lime in cement, and a method of analyzing air-entraining admixtures used in portland cement concrete.

Cement, aggregates, and concrete

Research on portland cement was confined largely to investigation of methods of test and to continuation of studies of cement begun a number of years ago.

A number of methods for testing cement are unsatisfactory but a comprehensive investigation of these methods apparently has been considered beyond the scope of a single laboratory due to the great amount of work involved. Under the auspices of Committee C-1 of the American Society for Testing Materials, two cooperative investigations were started to study the development or improvement of methods of testing cement. In the first study, tests were made to evaluate the adequacy of a proposed method for determining the resistance of cement to sulfate action. The results obtained have been reported to the committee and the development of a standardized method of test for sulfate-resistant cement is expected.

For a number of years air-entraining portland cements have been tested for acceptance by using a test of mortar to determine the amount of entrained air. This method has not given consistently uniform results and a cooperative investigation was started to determine whether and how the test procedure could be improved. The program of tests is one of the most detailed and exhaustive attempted in recent years.

The great demand for portland cement has led to consideration of the use of additives having pozzolanic properties. Since fly ash is considered to be of this nature and is very readily available, an investigation of the use of fly ash as a partial replacement of portland cement in concrete for pavements has been started. Samples of fly ash have been obtained from a large number of sources and preparations are being made for a series of tests to determine the effect of the fly ash on the strength and durability of cement mortars. A companion investigation of the effect of certain of these fly ashes on the properties of concrete is also planned.

Research investigations on aggregates were directed principally to determination of chemical stability. Samples of aggregates from all sources located near the District of Columbia were obtained for alkali-aggregate tests. Studies of concrete in and near Washington have shown some evidence of an alkali-aggregate reaction but, since this evidence may readily be destroyed by weathering, the question of a reaction of local aggregates with the alkali in cement remains in doubt. It is expected that these tests will assist in determination of the extent to which the alkali-aggregate reaction has contributed to failure of concrete in the Washington area.

The failure at an early age of test specimens prepared with reactive aggregates and high-alkali cement is expected and is found in tests. However, little knowledge exists of the behavior of specimens prepared with reactive aggregates and a low-alkali cement. It is known that these specimens may expand a small amount during a storage period of a year or two, but their behavior at greater ages is not known. Materials which cause a slow but continual expansion may be more objectionable than those which disclose their reactive nature at early ages. Studies are being made with specimens which will be stored for periods up to 10 years.

Tests of coarse aggregates for reaction with the alkali in cement are customarily made with the aggregate reduced to a sand or a powder. When the aggregate is not in the condition in which it will be used in concrete, the reliability of test results may be questioned. In a number of cases it has been found that mortars prepared with coarse aggregates crushed to sand size have developed much more expansion than concrete prepared with the same aggregate and a nonreactive sand. It is believed that in the determination of the chemical stability of a coarse aggregate, it is highly desirable to base the acceptance of the aggregate on the performance of concrete prepared with the material. A series of tests to determine the relative expansion of mortar and concrete prepared with the same materials is in progress.

Much of the research on portland cement concrete is directed toward improvement of its durability or resistance to natural weathering. The successful use of air-entrained concrete exposed to severe weathering conditions has resulted in the merchandising of numerous proprietary admixtures to entrain air. A questionnaire was sent to all known manufacturers of air-entraining materials requesting samples and information regarding their product. Twenty-six admixtures were received. These were tested to determine their air-entraining properties and their effect on strength and durability. On the basis of laboratory tests and evaluation of the data and information furnished by the manufacturers, the special provisions of the Bureau specifications were amended to list 20 air-entraining admixtures instead of the 3 previously shown. All these admixtures, as represented by samples submitted to the laboratory during 1950, were used in sufficient quantity to entrain air within the usual limits of 3 to 6 percent and in no case was the resulting compressive or flexural strength at 28 days less than 90 percent of the strength of similar concrete without the admixture. The durability of concrete containing each of these admixtures, as measured by freezing and thawing tests, was substantially improved. These 20 proprietary admixtures were given tentative approval subject to final approval after tests at an age of 1 year have been completed.

The study of the effect of the use of oils on the surface of hardened concrete to protect it from the destructive effect of raw flake calcium chloride used for ice removal was continued. This effect was determined by observing the action of the salt when applied repeatedly to thaw films of ice one-fourth inch thick on test specimens. Similar studies, as well as field tests, have been made by the New York State Department of Public Works. The tests made by both organizations show that the oils were somewhat effective in delaying the action of the calcium chloride.

The study of the effect of oils and asphalt emulsions used as admixtures on the properties of concrete was completed. The properties studied included strength, workability, and durability. Asphalt-base oil, paraffin-base oil, used crank-case oil, and asphalt emulsions were used. The laboratory tests show that the effect of these admixtures is proportional to the air entrained in the concrete. The use of asphalt-base oil and paraffin-base oil did not entrain any additional air in the concrete and these oils caused little change of strength or durability. Used crank-case oil and asphalt emulsions were found to increase the durability of the concrete by increasing the amount of entrained air.

Field experiments are being conducted in Kansas to determine whether the type of cement and method of curing concrete which were used 25 or more years ago would furnish a more durable pavement than the modern type of cement and curing method. To obtain additional information, a series of tests was made in the laboratory to determine the relative efficiency of the formerly used method of water curing for 10 days and the modern method involving the use of a membrane formed by nonbituminous liquid compounds. The tests have been completed. The results show that for plain concrete the wet method of curing furnished the most durable concrete and that the concrete cured with membranes was superior to concrete which received no curing treatment. When air-entrained concrete was tested, however, little difference was found among the specimens subjected to the three curing treatments.

The long-time study of cement performance in concrete, described in detail in previous annual reports, has been continued. Periodic inspections of the condition of the concrete test specimens exposed to weathering at the laboratory exposure plot, as well as inspections of full-size experimental installations in the field, have been made. A summary of the observations on the New York test road served as a basis for a paper published in a society journal. It was shown that, 7½ years after the test pavement was completed, the effects of air entrainment in improving resistance to scaling and weathering overshadow all other variables. Except for this, there were no significant differences in performance between individual cements or between types of cement.

Structural design of nonrigid pavements

A concerted effort is being made to improve methods for the structural design of pavements. This is particularly evident in the practice for nonrigid or flexible pavements. About half of the State highway departments have adopted some systematic procedure for determining the required thickness for given conditions of load, traffic density, subgrade condition, climate, etc., in sharp contrast to the situation a few years ago when thickness determination was left to the judgment of the engineer. The Bureau has been active in the effort to develop more rational bases for design. Through participation in cooperative experimental work and through technical committee activities it has sought to encourage and assist in this development.

Mention has been made in previous reports of a cooperative investigation dealing with the structural design of nonrigid pavement in which the Highway Research Board and the Asphalt Institute are participating, the experimental work being centered at Hybla Valley, Va. One of the principal objectives of this investigation is the development of fundamental data on the load-carrying capacity of pavement sections of various thicknesses. This is being accomplished by tests with both static and moving loads.

The program of static load tests as originally scheduled has been completed, and the moving load tests are now in progress. The results of the static tests indicate that the elastic action of a flexible pavement and its supporting subgrade may serve as an acceptable criterion of the traffic loads which it will safely carry. If this indication is substantiated by the results of the moving load tests, considerable progress will have been made toward a rational solution to the problem of structural design of flexible pavements.

Structural design of rigid pavements

Observations on the six experimental joint-spacing projects in California, Kentucky, Michigan, Minnesota, Missouri, and Oregon were continued. These pavements were constructed cooperatively in 1940–41 and were designed primarily to develop information on the expansion space requirements in plain concrete pavements with closely spaced transverse joints. The information obtained from the systematic observation of these pavements has led to a modification of design practice. At the last annual meeting of the Highway Research Board a report of the 10-year performance of three of these pavements was presented. The reports covered pavements constructed in 1940 in Kentucky, Michigan, and Minnesota. It is expected that a similar 10-year report will be presented for each of the remaining three projects at the next annual meeting of the Board.

Study of the effects on performance of various amounts of longitudinal steel in concrete pavements was continued. This is a joint study of the Indiana State Highway Commission and the Bureau. A 10-year report was presented at the 1949 meeting of the Highway Research Board. Observations of a limited nature are still being made on this pavement.

It has been observed in field studies that the frequency of transverse cracking in concrete pavements varies in some instances with the type or source of the coarse aggregate used in the concrete. Certain preliminary studies made by the Bureau have indicated that this might be influenced by differences in the thermal expansion of the concretes containing these different materials. In order to obtain more positive evidence on this subject, selected coarse aggregates were obtained from several States for use in preparing specimens suitable for a study of thermal expansion characteristics. These specimens were being made at the end of the year and it is hoped that the study will help to clarify a phenomenon that is, at present, obscure.

Laboratory study of the structural design of joints in concrete pavements was continued. For this study a special machine was developed which applies repeated loads to the joint in a systematic manner. Important information was obtained from these tests and an expansion of the program is contemplated.

Bridges

The study of the self-damping characteristics of structural members in suspension bridges, undertaken for the Advisory Board on the Investigation of Suspension Bridges and mentioned in previous reports, was virtually concluded with the publication, by the American Society of Civil Engineers, of a paper by a Bureau engineer which reported the more important aspects of the investigation and its principal findings. A paper containing a more detailed account of the experimental work is planned.

Preparation was made for a study of the structural action of highway bridges under moving loads. The equipment for this investigation was tested and installed in a trailer laboratory for field use. In anticipation of this field study a limited series of exposure tests was made to determine the relative efficacy of a number of waterproofing compounds when used as protective coatings on resistance strain gages mounted on steel. A short report on the results of this study has been prepared.

Other physical research

The Bureau has studied means for evaluating the roughness of road surfaces over a period of many years. A wide variety of instruments and methods have been studied. A piece of apparatus in the form of a single-wheel trailer was developed and described some 10 years ago. The equipment has been duplicated by a number of State highway departments and by several foreign governmental agencies. This equipment gives data that are expressed numerically as a roughness index for a given pavement. For certain specialized studies there has been some demand for a graphic record rather than a numerical value. During the year a simple but apparently satisfactory means for producing such a record was developed. It utilizes strain measuring and recording equipment commercially available and does not in any way interfere with the normal operation of the roughness indicator.

The Bureau has pioneered in the application of geophysical methods of subsurface exploration to civil engineering problems, particularly to those confronting the highway engineer. This work is attracting the attention of a constantly growing field of engineers and administrators and is being used by an increasing number of agencies and individuals. By means of field demonstrations, technical papers, and similar means, the Bureau has sought to acquaint the engineering profession with the technical and economic possibilities of this method of obtaining information regarding subsurface conditions. This effort has met with much success.

During the past year the earth-resistivity method was used to obtain design data on grading projects in Maryland, New Jersey, and Pennsylvania. Demonstration tests were made in Connecticut, New Jersey, Pennsylvania, and Virginia. As a result of these and earlier demonstrations, several additional State highway departments are equipping themselves for this type of exploration work.

This activity is always of great interest to engineers from foreign countries because the methods offer means for developing information regarding underground formations of engineering significance, quickly and at relatively small expense.

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Table 1.—*Summaries of programs approved and work completed in the fiscal year 1951, by class of highway and by fund*

	PROGRAMS APPROVED [1]						WORK COMPLETED					
	Total cost	Federal funds	Miles	Railway-highway crossing improvements: Crossings eliminated	Railway-highway crossing improvements: Structures reconstructed	Railway-highway crossing improvements: Crossings protected	Total cost	Federal funds	Miles	Railway-highway crossing improvements: Crossings eliminated	Railway-highway crossing improvements: Structures reconstructed	Railway-highway crossing improvements: Crossings protected
	BY CLASS OF HIGHWAY						BY CLASS OF HIGHWAY					
Primary	$478, 584, 168	$236, 690, 668	6, 864. 4	61	5	81	$287, 481, 686	$149, 474, 702	4, 849. 7	47	25	74
Secondary	257, 130, 706	135, 433, 628	13, 052. 6	25	2	194	232, 389, 735	118, 434, 631	13, 875. 0	15	11	210
Urban	314, 887, 252	150, 042, 499	781. 5	64	7	35	211, 955, 697	103, 358, 701	554. 1	63	12	73
Subtotal	1, 050, 602, 126	522, 166, 795	20, 698. 5	150	14	310	731, 827, 118	374, 268, 034	19, 278. 8	125	48	357
Not classified [2]	36, 394, 615	31, 217, 989	818. 9				33, 172, 146	28, 722, 563	751. 7			
Total	1, 086, 996, 741	553, 384, 784	21, 517. 4	150	14	310	764, 999, 264	402, 990, 597	20, 030. 5	125	48	357
	BY FUND						BY FUND					
Federal-aid:												
Primary	$514, 858, 448	$255, 080, 802	7, 261. 7	65	6	89	$314, 429, 442	$163, 266, 621	5, 163. 7	50	23	92
Secondary	252, 286, 741	129, 856, 040	12, 910. 2	23	2	191	233, 244, 300	118, 653, 074	13, 807. 5	12	15	166
Urban	274, 584, 313	129, 140, 762	356. 6	56	5	21	160, 223, 200	78, 437, 112	185. 3	46	4	6
Prewar Federal-aid:												
Primary							5, 590, 758	2, 609, 495	22. 8			
Secondary							3, 780, 039	1, 822, 487	66. 7			
Grade crossing	1, 817, 410	1, 295, 974	1. 0	5	1	9	10, 495, 631	7, 449, 985	26. 5	17	6	93
Access roads, Act of 1950	7, 055, 214	6, 793, 217	169. 0	1			38, 000	38, 000				
Emergency highway & grade crossing							8, 175	7, 112	. 3			
Defense Highway Act							4, 017, 573	1, 984, 148	6. 0			
Subtotal	1, 050, 602, 126	522, 166, 795	20, 698. 5	150	14	310	731, 827, 118	374, 268, 034	19, 278. 8	125	48	357
National forest highway [3]	19, 048, 943	18, 502, 574	517. 2				22, 689, 003	21, 030, 937	567. 5			
National park and parkway [4]	7, 660, 800	7, 660, 800	100. 0				4, 479, 550	4, 479, 550	115. 9			
Public lands	1, 127, 924	1, 064, 711	47. 3				616, 427	505, 684	12. 6			
Emergency flood relief	8, 556, 948	3, 989, 904	154. 4				5, 387, 163	2, 706, 392	55. 7			
Subtotal	36, 394, 615	31, 217, 989	818. 9				33, 172, 146	28, 722, 563	751. 7			
Total	1, 086, 996, 741	553, 384, 784	21, 517. 4	150	14	310	764, 999, 264	402, 990, 597	20, 030. 5	125	48	357

[1] Initial commitment of funds.
[2] Forest, park, public lands, and emergency flood-relief projects.
[3] Includes construction projects only.
[4] Construction supervised by Bureau of Public Roads.

Table 2.—*Projects under construction or plans approved on June 30, 1951, by class of highway and by fund*

	Total cost	Federal funds	Miles	Railway-highway crossing improvements		
				Crossings eliminated	Structures reconstructed	Crossings protected
By Class of Highway						
Primary	$592, 565, 857	$303, 108, 605	7, 980. 9	93	20	85
Secondary	305, 040, 515	157, 969, 006	12, 392. 0	23	7	196
Urban	639, 120, 707	313, 255, 884	1, 150. 1	133	20	51
Subtotal	1, 536, 727, 079	774, 333, 495	21, 523. 0	249	47	332
Not classified [1]	48, 833, 338	41, 330, 112	1, 047. 9			
Total	1, 585, 560, 417	815, 663, 607	22, 570. 9	249	47	332
By Fund						
Federal-aid:						
Primary	$661, 278, 005	$334, 547, 315	8, 569. 7	102	23	99
Secondary	299, 100, 394	151, 674, 074	12, 220. 6	21	8	183
Urban	532, 687, 944	259, 517, 519	469. 4	110	11	14
Prewar Federal-aid:						
Primary	6, 914, 005	3, 380, 583	15. 0			
Secondary	3, 901, 325	2, 072, 958	55. 0			
Grade crossing	11, 619, 062	8, 535, 117	29. 2	13	5	36
Access roads, Act of 1950	5, 266, 764	5, 004, 767	157. 6	1		
Emergency highway and grade crossing	711, 525	711, 525		2		
Defense Highway Act	15, 248, 055	8, 889, 637	6. 5			
Subtotal	1, 536, 727, 079	774, 333, 495	21, 523. 0	249	47	332
National forest highway [2]	22, 002, 084	20, 183, 282	563. 6			
National park and parkway [3]	15, 241, 329	15, 241, 329	280. 6			
Public lands	1, 010, 563	925, 709	46. 4			
Emergency flood relief	10, 579, 362	4, 979, 792	157. 3			
Subtotal	48, 833, 338	41, 330, 112	1, 047. 9			
Total	1, 585, 560, 417	815, 663, 607	22, 570. 9	249	47	332

[1] Forest, park, public lands, and emergency flood-relief projects.
[2] Includes construction projects only.
[3] Construction supervised by Bureau of Public Roads.

Table 3.—*Apportionment of Federal-aid highway funds authorized for the fiscal year ended June 30, 1952*

State or Territory	Federal-aid highway system ($225,000,000)	Secondary or feeder roads ($150,000,000)	Urban highways ($125,000,000)	Total
Alabama	$4, 710, 014	$3, 654, 018	$1, 598, 395	$9, 962, 427
Arizona	3, 308, 306	2, 253, 123	474, 550	6, 035, 979
Arkansas	3, 703, 775	2, 964, 576	682, 502	7, 350, 853
California	10, 244, 021	5, 276, 855	10, 845, 211	26, 366, 087
Colorado	4, 011, 724	2, 679, 292	1, 013, 977	7, 704, 993
Connecticut	1, 416, 259	727, 500	2, 362, 840	4, 506, 599
Delaware	1, 091, 250	727, 500	250, 213	2, 068, 963
Florida	3, 547, 205	2, 317, 735	2, 187, 694	8, 052, 634
Georgia	5, 535, 806	4, 224, 971	1, 778, 042	11, 538, 819
Idaho	2, 758, 529	1, 939, 559	234, 803	4, 932, 891
Illinois	8, 573, 480	4, 667, 413	8, 532, 279	21, 773, 172
Indiana	5, 294, 550	3, 648, 852	2, 918, 798	11, 862, 200
Iowa	5, 397, 723	3, 948, 357	1, 448, 416	10, 794, 496
Kansas	5, 442, 479	3, 808, 608	1, 146, 703	10, 397, 790
Kentucky	4, 088, 464	3, 396, 604	1, 266, 983	8, 752, 051
Louisiana	3, 431, 721	2, 485, 811	1, 788, 426	7, 705, 958
Maine	1, 887, 806	1, 349, 802	509, 899	3, 747, 507
Maryland	1, 957, 670	1, 196, 436	2, 070, 619	5, 224, 725
Massachusetts	2, 814, 013	1, 040, 491	5, 078, 072	8, 932, 576
Michigan	6, 929, 559	4, 228, 806	5, 678, 338	16, 836, 703
Minnesota	5, 871, 753	4, 140, 664	1, 986, 689	11, 999, 106
Mississippi	3, 978, 959	3, 314, 442	675, 476	7, 968, 877
Missouri	6, 443, 162	4, 359, 401	3, 004, 629	13, 807, 192
Montana	4, 513, 057	3, 103, 224	287, 288	7, 903, 569
Nebraska	4, 327, 171	3, 068, 485	715, 558	8, 111, 214
Nevada	2, 885, 661	1, 928, 291	92, 917	4, 906, 869
New Hampshire	1, 091, 250	727, 500	353, 897	2, 172, 647
New Jersey	2, 882, 902	971, 058	5, 340, 749	9, 194, 709
New Mexico	3, 646, 852	2, 504, 443	400, 399	6, 551, 694
New York	10, 494, 473	4, 211, 634	16, 307, 470	31, 013, 577
North Carolina	5, 473, 679	4, 683, 684	1, 567, 757	11, 725, 120
North Dakota	3, 250, 522	2, 358, 755	206, 299	5, 815, 576
Ohio	7, 768, 639	4, 725, 223	7, 060, 146	19, 554, 008
Oklahoma	4, 787, 712	3, 426, 696	1, 332, 927	9, 547, 335
Oregon	3, 838, 173	2, 681, 041	978, 287	7, 497, 501
Pennsylvania	8, 735, 974	5, 197, 788	9, 236, 247	23, 170, 009
Rhode Island	1, 091, 250	727, 500	872, 163	2, 690, 913
South Carolina	3, 015, 703	2, 493, 923	839, 253	6, 348, 879
South Dakota	3, 448, 903	2, 464, 357	236, 967	6, 150, 227
Tennessee	4, 765, 308	3, 720, 575	1, 764, 242	10, 250, 125
Texas	14, 393, 485	9, 636, 793	5, 844, 803	29, 875, 081
Utah	2, 568, 068	1, 698, 694	516, 966	4, 783, 728
Vermont	1, 091, 250	727, 500	189, 966	2, 008, 716
Virginia	4, 229, 828	3, 287, 110	1, 902, 516	9, 419, 454
Washington	3, 701, 693	2, 472, 536	1, 840, 890	8, 015, 119
West Virginia	2, 424, 837	2, 111, 534	794, 020	5, 330, 391
Wisconsin	5, 283, 151	3, 684, 961	2, 389, 089	11, 357, 201
Wyoming	2, 774, 425	1, 880, 040	132, 656	4, 787, 121
District of Columbia	1, 091, 250	727, 500	410, 261	2, 229, 011
Hawaii	1, 091, 250	727, 500	1, 054, 005	2, 872, 755
Puerto Rico	1, 145, 306	1, 200, 839	1, 048, 708	3, 394, 853

Table 4.—***Status of plan preparation for future construction of Federal-aid and State highways, and highways in National forests and other Federal areas, as of April 1, 1951***

State or Territory	Plans under way		Plans completed		Total	
	Construction cost	Miles	Construction cost	Miles	Construction cost	Miles
	1,000 dollars		*1,000 dollars*		*1,000 dollars*	
Alabama	23, 205	630	5, 800	152	29, 005	782
Arizona	16, 649	277	1, 300	27	17, 949	304
Arkansas	24, 268	657	12, 658	311	36, 926	968
California	490, 128	2, 038	79, 919	842	570, 047	2, 880
Colorado	23, 312	972	2, 365	161	25, 677	1, 133
Connecticut	47, 776	185	572	2	48, 348	187
Delaware	12, 500	96	935	10	13, 435	106
Florida	15, 000	400	4, 000	100	19, 000	500
Georgia	62, 619	2, 970	24, 757	334	87, 376	3, 304
Idaho	27, 050	642	12, 665	200	39, 715	842
Illinois	100, 607	1, 122	42, 824	724	143, 431	1, 846
Indiana	132, 047	964	18, 947	151	150, 994	1, 115
Iowa	48, 000	1, 850	9, 000	450	57, 000	2, 300
Kansas	19, 096	1, 336	7, 778	385	26, 874	1, 721
Kentucky	13, 000	2, 000	11, 000	1, 500	24, 000	3, 500
Louisiana	20, 222	263	22, 786	329	43, 008	592
Maine	17, 886	102	5, 231	64	23, 117	166
Maryland	17, 042	65	23, 743	62	40, 785	127
Massachusetts	140, 179	244	29, 370	27	169, 549	271
Michigan	71, 500	650	33, 000	300	104, 500	950
Minnesota	35, 863	1, 411	19, 622	1, 124	55, 485	2, 535
Mississippi	21, 794	566	2, 935	89	24, 729	655
Missouri	27, 851	417	15, 760	430	43, 611	847
Montana	17, 951	532	5, 416	128	23, 367	660
Nebraska	24, 595	793	4, 754	157	29, 349	950
Nevada	12, 456	452	4, 077	217	16, 533	669
New Hampshire	8, 573	71	1, 437	13	10, 010	84
New Jersey	270, 350	302	50, 457	88	320, 807	390
New Mexico	22, 449	516	5, 800	77	28, 249	593
New York	380, 000	1, 090	200, 000	410	580, 000	1, 500
North Carolina	55, 316	854	9, 384	292	64, 700	1, 146
North Dakota	6, 754	277	5, 294	223	12, 048	500
Ohio	140, 747	765	4, 595	105	145, 342	870
Oklahoma	26, 734	443	5, 120	127	31, 854	570
Oregon	14, 346	243	7, 707	198	22, 053	441
Pennsylvania	331, 392	1, 154	134, 244	1, 095	465, 636	2, 249
Rhode Island	11, 069	56	2, 436	5	13, 505	61
South Carolina	24, 000	500	4, 000	150	28, 000	650
South Dakota	14, 620	741	9, 530	794	24, 150	1, 535
Tennessee	36, 129	579	7, 092	146	43, 221	725
Texas	95, 705	3, 548	12, 871	902	108, 576	4, 450
Utah	26, 156	559	4, 046	146	30, 202	705
Vermont	7, 700	91	2, 135	25	9, 835	116
Virginia	50, 708	926	22, 809	514	73, 517	1, 440
Washington	194, 140	1, 593	2, 188	37	196, 328	1, 630
West Virginia	5, 701	41	4, 515	68	10, 216	109
Wisconsin	20, 315	575	15, 175	413	35, 490	988
Wyoming	37, 742	1, 070	1, 644	31	39, 386	1, 101
Alaska	6, 204	32	450	5	6, 654	37
District of Columbia	14, 937	8	13, 782	15	28, 719	23
Hawaii	10, 525	56	5, 811	12	16, 336	68
Puerto Rico	11, 422	55	5, 206	38	16, 628	93
Total	3, 286, 330	37, 779	938, 942	14, 205	4, 225, 272	51, 984

Table 5.—*Projects financed with Federal-aid funds programed* [1] *during the fiscal year ended June 30, 1951, by State*

State or Territory	Primary			Secondary			Urban			Total		
	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles
Alabama	$9,081,934	$4,769,837	90.8	$8,282,790	$3,957,219	479.9				$17,367,724	$8,737,056	570.7
Arizona	7,075,830	4,873,219	108.4	2,799,808	1,991,735	91.4	$753,783	$528,817	5.0	10,634,421	7,393,771	204.8
Arkansas	7,558,680	3,786,140	174.9	4,551,156	2,287,183	273.9	249,805	123,250	2.1	12,359,641	6,196,573	450.9
California	33,247,178	9,493,493	91.1	10,760,629	5,845,320	193.8	35,103,902	10,361,302	18.3	79,114,709	25,700,115	309.2
Colorado	6,295,764	3,565,707	160.7	4,893,502	2,771,931	213.2	1,727,106	803,616	.5	12,916,372	7,146,304	401.1
Connecticut	3,133,254	1,566,202	9.4	1,330,164	663,402	2.5	5,026,748	2,698,367	7.6	9,490,163	4,927,971	19.5
Delaware	1,735,058	867,529	7.2	945,000	565,000	3.4	6,040	2,719		2,686,098	1,435,248	10.6
Florida	10,687,013	5,535,012	133.9	6,180,604	2,977,323	301.4	4,355,462	2,177,736	19.0	21,223,079	10,690,071	451.3
Georgia	14,928,939	7,350,305	134.7	4,151,520	2,126,558	183.8	911,234	455,612	.5	19,991,743	9,932,505	319.0
Idaho	6,518,031	3,388,181	147.7	3,046,485	1,870,935	163.3	234,691	173,549	.1	9,849,210	5,432,715	314.1
Illinois	25,305,593	12,615,994	415.2	3,979,235	1,974,378	177.3	14,885,438	8,139,750	3.9	44,170,266	22,770,122	596.4
Indiana	22,149,728	11,097,062	256.5	6,823,640	3,193,986	106.5	9,749,443	4,671,451	25.3	38,722,811	18,962,499	388.3
Iowa	9,856,201	4,617,592	271.8	9,789,088	4,901,635	793.6	6,241,008	3,102,770	31.7	25,889,297	12,621,997	1,097.1
Kansas	10,497,581	5,049,071	292.4	4,992,517	2,461,124	1,140.2	666,242	328,451	2.6	16,156,340	7,838,646	1,435.2
Kentucky	8,120,689	4,148,582	129.5	6,798,035	3,518,517	171.5	4,736,000	2,529,500	24.4	19,654,721	10,196,599	328.4
Louisiana	8,764,302	4,258,860	74.1	7,551,330	3,515,668	71.4	530,220	265,110	3.2	16,845,852	8,039,638	148.7
Maine	217,500	114,650	1.4	465,510	200,309	5.9	1,588,904	884,321	1.5	2,271,914	1,199,280	8.8
Maryland	3,332,690	1,661,345	10.8	755,503	408,372	64.5	5,505,457	2,917,000	6.2	9,593,650	4,986,717	81.5
Massachusetts	9,140,836	2,976,760	11.4	2,018,590	1,139,120	16.4	13,502,877	5,248,963	8.5	24,662,303	9,364,843	36.3
Michigan	16,700,660	8,531,130	245.2	8,771,957	4,440,462	504.0	10,345,170	4,860,626	5.0	35,817,787	17,832,218	754.2
Minnesota	10,843,675	5,642,912	284.5	9,039,432	4,585,118	1,293.9	2,753,252	2,040,395	4.1	22,636,359	12,268,425	1,582.5
Mississippi	13,073,864	6,938,463	349.1	3,584,900	1,757,042	133.0	3,141,788	1,570,894	16.7	19,800,552	10,266,399	498.8
Missouri	12,642,241	6,255,308	182.6	7,000,396	3,658,322	667.6	1,796,690	1,108,529	2.6	21,439,327	11,022,159	852.8
Montana	4,702,389	2,837,181	87.6	5,391,603	3,200,754	289.0	837,877	704,520	.9	10,931,869	6,742,455	377.5
Nebraska	4,600,713	2,153,488	138.2	2,730,448	1,399,377	116.9	484,448	264,373	.7	7,815,609	3,817,238	255.8
Nevada	2,912,397	2,454,797	89.9	1,921,912	1,613,566	100.8	65,126	53,853	.3	4,899,435	4,122,216	191.0
New Hampshire	1,587,928	781,452	12.4	908,431	429,376	10.9	762,500	575,500	3.0	3,258,859	1,786,328	26.3
New Jersey	5,185,210	2,578,290	10.5	1,260,043	607,113	9.9	17,613,914	8,625,672	8.0	24,059,167	11,811,075	28.4
New Mexico	10,106,784	6,451,594	141.5	3,406,119	2,178,556	213.3	709,854	451,754	.5	14,222,757	9,081,904	355.3
New York	23,427,556	11,493,640	237.8	4,245,984	2,051,195	37.4	65,628,322	31,028,848	66.0	93,301,862	44,573,683	341.2
North Carolina	17,628,071	8,658,926	255.0	9,691,561	4,821,496	392.7	2,662,042	1,303,462	5.8	29,981,674	14,783,884	653.5
North Dakota	8,692,107	4,347,410	459.9	8,423,101	4,187,952	1,246.4	446,000	223,000	1.7	17,561,208	8,758,362	1,708.0

Ohio	18, 296, 550	8, 610, 015	107. 1	12, 343, 472	6, 160, 301	164. 5	6, 661, 112	3, 264, 935	15. 1	37, 301, 134	18, 035, 251	286. 7
Oklahoma	13. 242, 230	6, 299, 760	177. 5	7, 138, 170	3, 196, 065	249. 0	3, 719, 100	1, 961, 714	12. 0	24, 099, 500	11, 457, 539	438. 5
Oregon	9. 176. 326	4, 681, 534	70. 0	3, 569, 472	2, 162, 066	131. 2	1, 372, 036	776, 526	2. 4	14, 117, 834	7, 620, 126	203. 6
Pennsylvania	17, 168, 942	8, 856, 471	30. 5	8, 924, 274	4, 452, 972	66. 0	9, 260, 606	4, 628, 435	3. 0	35, 353, 822	17, 937, 878	99. 5
Rhode Island	511, 789	252, 083	. 4	1, 447, 664	723, 832	8. 6				1, 959, 453	975, 915	9. 0
South Carolina	11, 695, 780	6, 004, 300	79. 9	2, 779, 727	1, 366, 777	202. 8	578, 575	295, 100	5. 4	15. 054, 082	7, 666, 177	288. 1
South Dakota	8, 428, 854	4, 825, 106	323. 0	4, 686, 091	2, 662, 977	471. 8	226, 053	126, 892	1. 7	13, 340, 998	7, 614, 975	796. 5
Tennessee	9, 016, 798	4, 143, 399	50. 1	5, 917, 134	2, 950, 167	328. 9	1, 450, 156	725, 078	1. 5	16, 384, 088	7, 818, 644	380. 5
Texas	40, 079, 416	20, 104, 250	637. 0	6, 053, 721	2. 992, 660	262. 8	15, 096, 872	7, 761, 100	14. 1	61, 230, 099	30, 858, 010	913. 9
Utah	3, 180, 251	2, 4[illegible]5, 537	34. 5	1, 809, 543	1, 335, 073	85. 9				4, 989, 794	3, 770, 610	120. 4
Vermont	1, 412, 569	710, 910	20. 3	2, 572, 425	1, 290, 674	37. 7	285, 934	160, 467	1. 4	4, 270, 928	2, 162, 051	59. 4
Virginia	12, 849, 177	6, 399, 493	205. 8	8, 881, 176	4, 446. 700	393. 6	2, 819, 383	1, 214, 796	10. 2	24, 549, 736	12, 060, 989	609. 6
Washington	8, 611, 836	4, 330, 426	96. 1	4, 366, 745	1, 942, 447	197. 7	3, 769, 134	1, 319, 735	. 3	16, 747, 715	7, 592, 608	294. 1
West Virginia	5, 331, 011	2, 650, 826	43. 5	4, 546, 400	2, 292, 963	93. 1	2, 698, 051	1, 839, 713	2. 2	12, 575, 462	6, 783, 502	138. 8
Wisconsin	13, 183, 841	6, 998, 507	221. 3	9, 274, 162	4, 499, 780	515. 7	6, 449, 107	3, 642, 671	8. 3	28, 907, 110	15, 140, 958	745. 3
Wyoming	4, 908, 372	3, 159, 423	121. 3	3, 317, 617	2, 153, 939	130. 0	126, 140	89, 037		8, 352, 129	5, 402, 399	251. 3
District of Columbia	2, 068, 800	1, 034, 400		619, 939	309, 900	2. 1	419, 138	209, 569		3, 107, 877	1, 553, 869	2. 1
Hawaii	3, 930, 920	1, 767, 135	15. 0	2, 317, 154	1, 084, 417	7. 8				6, 248, 074	2, 851, 552	22. 8
Puerto Rico	2, 011, 590	927, 095	9. 3	5, 230, 862	2. 512, 186	52. 3	6, 540, 520	2, 896, 254	3. 3	13, 782, 972	6, 335, 535	64. 9
Total	514, 858, 448	255, 080, 802	7, 261. 7	252, 286, 741	129, 856, 040	12, 910. 2	274, 584, 13	129, 140, 762	356. 6	1,041,729,502	514, 077, 604	20, 528. 5

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[1] Initial commitment of funds.

Table 6.—*Projects involving Federal funds awarded to contract [1] during the fiscal year ended June 30, 1951, by program and by State*

State or Territory	Total cost	Total Federal funds	Federal-aid funds			Prewar Federal-aid funds			Other	Miles
			Primary [2]	Secondary	Urban	Primary	Secondary	Grade crossing		
Alabama	$14, 544, 131	$7, 168, 700	$3, 613, 570	$3, 186, 939				$368, 191		527. 6
Arizona	5, 224, 253	3, 676, 275	2, 561, 938	752, 911	$316, 848		$44, 578			108. 6
Arkansas	10, 479, 712	5, 479, 287	2, 537, 449	2, 780, 363	161, 475					364. 6
California	38, 748, 173	19, 301, 365	9, 558, 819	3, 909, 846	5, 821, 300				$11, 400	271. 5
Colorado	10, 337, 785	5, 864, 121	3, 176, 994	2, 490, 377	196, 750					361. 1
Connecticut	9, 222, 527	4, 886, 031	1, 629, 854	345, 161	2, 908, 718			2, 298		7. 7
Delaware	4, 017, 298	1, 978, 813	1, 068, 923	909, 890						38. 8
Florida	20, 121, 732	10, 107, 704	4, 680, 556	2, 741, 615	2, 685, 533					451. 5
Georgia	20, 545, 457	10, 319, 188	5, 201, 902	4, 090, 519	912, 721		109, 736	4, 310		540. 9
Idaho	8, 234, 238	4, 584, 678	2, 907, 123	1, 346, 828	170, 727				160, 000	298. 8
Illinois	43, 526, 228	22, 171, 932	10, 781, 127	2, 102, 635	9, 288, 170					501. 9
Indiana	12, 063, 995	6, 405, 369	2, 420, 002	1, 784, 718	2, 200, 649					77. 6
Iowa	21, 133, 915	10, 569, 956	5, 583, 270	3, 619, 932	1, 366, 754					941. 4
Kansas	20, 778, 082	10, 401, 059	6, 978, 371	2, 246, 217	1, 158, 541	$17, 930				1, 398. 8
Kentucky	11, 901, 057	6, 223, 004	2, 743, 935	2, 315, 474	626, 120				537, 475	223. 6
Louisiana	17, 364, 385	8, 788, 606	5, 408, 663	2, 774, 030	364, 900			241, 013		214. 6
Maine	5, 718, 122	3, 049, 574	1, 436, 909	1, 373, 953	134, 907			103, 805		54. 8
Maryland	7, 480, 744	3, 290, 835	1, 131, 000	796, 835	1, 363, 000					49. 5
Massachusetts	20, 331, 474	10, 192, 273	3, 513, 016	475, 215	6, 188, 405	15, 637				17. 6
Michigan	25, 520, 438	13, 198, 204	6, 125, 548	3, 932, 360	3, 140, 296					672. 2
Minnesota	22, 217, 948	12, 449, 691	5, 425, 689	3, 948, 161	3, 075, 841					1, 465. 1
Mississippi	16, 750, 509	8, 783, 823	5, 184, 348	3, 191, 075	408, 400					615. 1
Missouri	23, 442, 723	12, 600, 116	7, 680, 374	3, 439, 282	1, 480, 460					887. 4
Montana	10, 491, 199	6, 241, 978	4, 584, 819	1, 615, 658	41, 501					355. 6
Nebraska	13, 720, 691	6, 792, 781	3, 932, 794	2, 115, 840	744, 147					473. 6
Nevada	3, 491, 583	2, 898, 980	1, 068, 553	1, 830, 427						196. 1
New Hampshire	4, 727, 207	2, 353, 025	1, 301, 014	963, 855	88, 156					52. 9
New Jersey	19, 011, 168	9, 179, 528	3, 751, 090	334, 272	5, 094, 166					27. 2
New Mexico	14, 459, 967	9, 335, 123	5, 460, 277	3, 036, 132	544, 126				294, 588	397. 3
New York	69, 408, 318	31, 162, 436	8, 286, 766	2, 756, 312	20, 119, 358					148. 0
North Carolina	25, 513, 993	12, 583, 421	7, 797, 191	4, 199, 633	573, 910			12, 687		676. 0
North Dakota	13, 294, 241	6, 653, 409	3, 248, 908	3, 400, 219	4, 282					1, 124. 6

Ohio	53, 834, 561	28, 887, 756	12, 879, 334	2, 933, 767	11, 878, 913	223, 032	696, 598	276, 112		424. 5
Oklahoma	26, 783, 323	13, 928, 024	7, 192, 496	3, 860, 218	2, 241, 365			633, 945		523. 7
Oregon	17, 430, 592	9, 337, 611	4, 528, 611	3, 466, 000	1, 343, 000					266. 5
Pennsylvania	45, 383, 171	22, 511, 400	6, 939, 000	5, 141, 400	10, 431, 000					146. 8
Rhode Island	5, 315, 020	2, 733, 369	1, 642, 931	714, 753	375, 685					20. 8
South Carolina	10, 574, 826	6, 599, 553	2, 265, 774	1, 218, 859	498, 500	10, 626			2, 605, 794	294. 0
South Dakota	11, 463, 971	6, 542, 323	3, 146, 382	3, 362, 503	4, 804		28, 634			885. 9
Tennessee	20, 557, 040	10, 398, 487	3, 886, 789	4, 008, 253	2, 503, 445					543. 4
Texas	60, 025, 474	30, 833, 071	17, 578, 019	5, 075, 612	8, 104, 065			75, 375		1, 329. 5
Utah	4, 862, 647	3, 755, 034	1, 270, 081	1, 807, 038	44, 165			16, 750	617, 000	207. 1
Vermont	2, 881, 799	1, 426, 564	853, 692	431, 753	141, 119					28. 9
Virginia	16, 761, 121	8, 292, 939	5, 200, 251	2, 732, 707	359, 981					406. 6
Washington	11, 771, 345	5, 868, 579	2, 089, 347	2, 599, 532	1, 008, 700				171, 000	202. 9
West Virginia	6, 825, 517	3, 492, 543	1, 236, 915	1, 440, 128	815, 500					91. 6
Wisconsin	22, 360, 283	11, 137, 590	6, 744, 534	2, 875, 699	767, 016			750, 341		625. 5
Wyoming	8, 738, 590	5, 471, 259	3, 579, 191	1, 892, 068						239. 9
District of Columbia	1, 765, 544	1, 070, 955	110, 733	960, 222						4. 8
Hawaii	3, 538, 295	1, 591, 501	401, 770	788, 211	401, 520					24. 3
Puerto Rico	4, 320, 943	2, 107, 196	423, 252	833, 164	837, 390		13, 390			18. 5
Total	899, 017, 355	464, 677, 039	222, 749, 894	120, 948, 571	112, 936, 329	267, 225	892, 936	2, 484, 827	4, 397, 257	19, 826. 7

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[1] Includes force-account projects placed under construction during the fiscal year.

[2] Funds available for either rural or urban portions of the Federal-aid highway system.

Table 7.—*Status of projects as of June 30, 1951, and projects completed during the fiscal year* [1]

State or Territory	Programed,[2] plans not approved			Plans approved, not under construction			Under construction			Completed during fiscal year		
	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles
Alabama	$13, 745, 412	$7, 009, 836	360. 9	$7, 344, 608	$3, 714, 244	162. 7	$17, 364, 844	$8, 416, 635	408. 5	$9, 235, 526	$4, 939, 333	414. 4
Arizona	7, 552, 520	5, 307, 952	169. 6	892, 248	516, 484	13. 3	4, 339, 791	3, 108, 539	49. 9	7, 800, 961	5, 370, 962	186. 9
Arkansas	12, 852, 450	6, 756, 625	423. 1	5, 325, 400	2, 656, 181	175. 3	13, 702, 332	7, 009, 409	360. 1	15, 022, 485	7, 355, 370	397. 3
California	39, 883, 614	6, 738, 863	183. 9	19, 294, 586	9, 229, 641	75. 5	62, 878, 055	30, 690, 524	302. 9	23, 446, 600	11, 307, 145	208. 6
Colorado	4, 345, 804	2, 455, 286	151. 1	4, 507, 298	2, 495, 248	121. 5	13, 628, 859	7, 469, 267	273. 1	15, 409, 093	8, 888, 166	385. 4
Connecticut	6, 247, 121	3, 173, 556	17. 9	2, 804, 526	1, 588, 353	7. 2	8, 637, 121	4, 617, 742	8. 1	7, 588, 272	4, 125, 675	12. 4
Delaware	1, 004, 000	599, 300	22. 5	10, 000	9, 000	----------	5, 332, 726	2, 601, 743	19. 1	4, 762, 599	2, 266, 183	83. 1
Florida	12, 934, 300	6, 617, 950	292. 6	7, 763, 295	4, 081, 034	117. 2	20, 044, 688	9, 861, 195	417. 9	9, 756, 544	4, 762, 922	291. 0
Georgia	11, 487, 176	5, 895, 508	142. 2	9, 721, 554	3, 976, 956	68. 4	32, 584, 747	16, 681, 294	680. 3	26, 940, 791	13, 185, 025	605. 4
Idaho	8, 541, 550	5, 436, 571	339. 4	2, 307, 508	1, 415, 793	87. 8	8, 489, 905	4, 879, 156	279. 8	6, 565, 363	3, 972, 371	216. 6
Illinois	34, 191, 534	18, 635, 089	324. 3	19, 237, 673	9, 687, 833	212. 0	68, 966, 202	35, 533, 685	550. 0	29, 860, 018	13, 818, 250	305. 6
Indiana	37, 216, 227	18, 632, 849	222. 6	8, 869, 017	4, 305, 553	181. 9	17, 436, 845	8, 851, 456	96. 3	9, 514, 899	5, 055, 052	49. 5
Iowa	9, 563, 417	4, 389, 176	392. 9	9, 067, 541	4, 453, 341	434. 8	19, 916, 040	10, 325, 956	596. 9	22, 093, 188	11, 074, 133	1, 090. 6
Kansas	7, 885, 186	3, 782, 660	1, 183. 4	6, 130, 264	3, 074, 360	306. 9	13, 027, 679	6, 497, 761	517. 2	20, 530, 798	10, 404, 837	1, 547. 9
Kentucky	22, 196, 227	11, 473, 113	330. 0	3, 904, 032	2, 192, 500	72. 1	17, 055, 239	8, 463, 224	275. 9	13, 909, 244	6, 933, 243	309. 4
Louisiana	15, 663, 332	7, 429, 866	105. 9	8, 505, 268	3, 994, 346	65. 5	18, 023, 279	9, 152, 557	201. 7	17, 349, 077	9, 170, 338	225. 7
Maine	7, 644, 654	4, 862, 267	71. 9	817, 382	367, 374	5. 9	7, 976, 639	4, 269, 009	70. 2	5, 185, 666	2, 559, 661	76. 8
Maryland	3, 691, 908	1, 851, 394	27. 4	5, 460, 213	3, 178, 980	45. 8	12, 567, 070	6, 029, 985	54. 7	11, 539, 516	5, 742, 788	67. 2
Massachusetts	15, 423, 938	5, 230, 547	34. 5	5, 845, 116	2, 240, 708	1. 6	70, 315, 523	35, 005, 322	59. 3	8, 865, 732	4, 570, 983	19. 9
Michigan	23, 664, 536	11, 874, 453	571. 2	10, 897, 924	5, 080, 028	260. 3	48, 852, 965	21, 286, 686	363. 7	23, 541, 173	11, 026, 234	485. 4
Minnesota	6, 596, 460	3, 552, 211	957. 8	8, 705, 009	5, 008, 763	659. 7	26, 867, 564	14, 095, 313	735. 6	19, 895, 815	10, 234, 336	1, 346. 1
Mississippi	4, 194, 148	2, 126, 859	152. 7	9, 555, 168	5, 129, 804	227. 1	13, 123, 383	6, 589, 153	374. 0	8, 155, 715	4, 274, 630	323. 0
Missouri	24, 661, 193	12, 725, 784	752. 9	15, 498, 360	7, 875, 568	401. 9	33, 925, 221	17, 816, 150	553. 1	16, 267, 658	8, 644, 109	753. 5
Montana	16, 744, 718	10, 175, 968	524. 2	5, 194, 345	3, 014, 059	152. 2	13, 617, 425	8, 187, 994	262. 6	11, 435, 383	6, 961, 420	474. 4
Nebraska	12, 571, 816	6, 640, 258	458. 7	5, 068, 205	2, 480, 233	98. 7	16, 827, 010	8, 758, 167	525. 0	10, 428, 074	5, 739, 780	248. 9
Nevada	5, 641, 784	4, 709, 665	174. 1	546, 226	467, 638	34. 9	3, 293, 494	2, 722, 148	130. 8	5, 431, 176	4, 308, 411	219. 8
New Hampshire	2, 719, 999	1, 533, 749	18. 8	418, 465	185, 144	5. 7	5, 676, 328	2, 818, 928	49. 9	3, 327, 755	1, 633, 006	28. 7
New Jersey	12, 283, 000	6, 131, 000	22. 5	9, 506, 776	4, 739, 073	3. 0	15, 458, 630	7, 302, 520	23. 6	14, 844, 735	7, 019, 567	27. 2
New Mexico	3, 673, 391	2, 353, 773	122. 6	2, 519, 635	1, 605, 360	46. 9	10, 728, 838	6, 958, 764	230. 1	10, 504, 793	6, 786, 024	409. 9
New York	75, 611, 566	39, 586, 033	233. 9	17, 720, 927	8, 099, 622	170. 8	112, 969, 019	52, 996, 907	250. 1	51, 867, 700	25, 463, 639	106. 6
North Carolina	16, 146, 754	8, 009, 804	393. 7	5, 010, 030	2, 378, 985	117. 0	29, 101, 744	14, 153, 789	625. 2	18, 902, 086	9, 215, 347	500. 9
North Dakota	11, 075, 261	5, 656, 815	1, 652. 8	7, 037, 835	3, 511, 892	467. 8	7, 800, 301	3, 892, 354	618. 4	11, 847, 900	5, 943, 442	925. 5

Ohio	31, 483, 604	14, 589, 943	276. 1	5, 333, 317	2, 718, 604	163. 4	82, 658, 080	41, 989, 132	342. 5	21, 514, 585	10, 472, 416	215. 1
Oklahoma	16, 562, 636	7, 620, 059	272. 7	5, 949, 700	3, 306, 180	123. 2	24, 346, 271	12, 315, 611	392. 8	18, 947, 021	9, 294, 410	585. 3
Oregon	3, 418, 000	2, 059, 500	33. 5	4, 063, 761	2, 229, 593	96. 8	16, 387, 899	9, 146, 355	217. 9	12, 366, 744	6, 748, 098	187. 2
Pennsylvania	17, 717, 520	9, 123, 760	52. 9	15, 486, 904	7, 739, 419	52. 8	86, 629, 118	42, 703, 569	232. 0	36, 485, 996	18, 151, 756	98. 9
Rhode Island	5, 612, 590	2, 806, 295	45. 7	1, 049, 877	564, 597	2. 5	14, 770, 751	7, 503, 497	17. 1	1, 798, 931	948, 906	9. 2
South Carolina	11, 996, 316	6, 192, 987	261. 5	2, 121, 945	1, 043, 330	54. 5	13, 484, 114	8, 263, 022	249. 5	10, 180, 499	5, 016, 238	541. 5
South Dakota	8, 124, 930	4, 754, 308	754. 6	5, 580, 196	3, 056, 435	291. 5	11, 199, 787	6, 760, 805	671. 0	8, 849, 475	5, 202, 720	896. 8
Tennessee	12, 544, 536	6, 146, 618	273. 5	8, 600, 786	4, 032, 893	198. 7	24, 344, 402	11, 539, 725	343. 5	14, 260, 640	6, 773, 771	444. 7
Texas	11, 253, 800	5, 104, 460	81. 7	18, 036, 697	9, 174, 939	198. 2	49, 328, 113	23, 339, 642	776. 2	54, 550, 656	27, 154, 649	2, 256. 1
Utah	5, 037, 045	3, 813, 650	109. 6	1, 299, 363	951, 298	39. 6	6, 254, 309	4, 732, 586	202. 0	5, 550, 783	3, 995, 836	151. 3
Vermont	4, 636, 042	2, 463, 174	61. 6	842, 582	427, 058	6. 2	4, 660, 496	2, 290, 230	32. 5	1, 968, 680	969, 833	30. 9
Virginia	19, 400, 502	9, 551, 326	518. 3	11, 831, 168	5, 905, 058	275. 0	16, 386, 932	8, 699, 939	280. 5	18, 508, 571	9, 482, 027	373. 3
Washington	10, 029, 025	3, 995, 447	174. 4	4, 599, 369	2, 255, 054	105. 7	21, 974, 084	10, 720, 915	132. 2	13, 069, 696	6, 208, 418	206. 1
West Virginia	11, 866, 502	6, 476, 934	124. 1	4, 291, 440	2, 150, 870	60. 1	9, 349, 027	4, 739, 715	99. 8	7, 857, 044	3, 913, 507	67. 9
Wisconsin	21, 029, 269	11, 546, 977	555. 5	11, 178, 188	5, 260, 570	203. 2	19, 749, 554	9, 751, 780	482. 4	18, 446, 536	9, 155, 039	515. 9
Wyoming	2, 044, 000	1, 300, 391	48. 3	1, 975, 869	1, 286, 990	60. 3	9, 362, 854	5, 877, 362	276. 2	6, 213, 644	4, 029, 115	303. 0
District of Columbia	2, 864, 240	1, 432, 120	. 7	2, 964, 790	1, 482, 300	3. 2	1, 175, 296	780, 389	----------	1, 071, 181	530, 913	3. 6
Hawaii	8, 288, 774	3, 810, 322	15. 3	1, 156, 650	378, 185	. 5	9, 440, 885	3, 546, 525	23. 7	2, 536, 927	1, 243, 663	21. 9
Puerto Rico	10, 500, 028	4, 901, 916	46. 8	4, 065, 169	1, 961, 437	14. 4	8, 781, 396	3, 910, 456	36. 0	5, 823, 174	2, 224, 337	26. 5
Total	702, 064, 355	349, 044, 967	14, 529. 8	335, 914, 205	168, 678, 908	6, 751. 2	1, 200, 812, 874	605, 654, 587	14, 771. 8	731, 827, 118	374, 268, 034	19, 278. 8

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[1] Includes projects financed from Federal-aid primary, secondary, and urban, prewar Federal-aid primary, secondary, and grade crossing, emergency highway and grade crossing, Defense Highway Act, and 1950 access funds.

[2] Initial commitment of funds.

Table 8.—*Status of projects as of June 30, 1951, and projects completed during the fiscal year,*[1] *on Federal-aid highway system in rural areas*

State or Territory	Programed,[2] plans not approved			Plans approved, not under construction			Under construction			Completed during fiscal year		
	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles
Alabama	$7, 433, 100	$3, 933, 250	65. 3	$2, 596, 016	$1, 299, 908	32. 8	$8, 880, 219	$4, 468, 406	101. 8	$3, 230, 870	$1, 606, 674	65. 4
Arizona	3, 760, 162	2, 628, 342	56. 1	178, 926	105, 230	3. 5	3, 593, 273	2, 584, 922	38. 5	4, 048, 499	2, 784, 488	62. 8
Arkansas	8, 240, 700	4, 130, 270	189. 2	3, 051, 380	1, 519, 930	63. 2	7, 395, 307	3, 906, 521	136. 1	7, 492, 790	3, 638, 386	118. 7
California	14, 751, 178	1, 055, 774	28. 4	4, 569, 667	1, 772, 387	13. 1	22, 004, 800	10, 670, 319	114. 8	13, 456, 094	6, 264, 015	77. 7
Colorado	2, 198, 661	1, 247, 182	72. 7	2, 707, 277	1, 532, 318	60. 8	7, 507, 985	4, 227, 445	124. 0	4, 471, 512	2, 448, 782	109. 9
Connecticut	1, 533, 726	816, 863	4. 9	255, 655	127, 827	4. 1	2, 801, 698	1, 593, 905	1. 4	1, 105, 489	806, 732	2. 4
Delaware	12, 000	10, 800	---	---	---	---	3, 253, 831	1, 625, 225	8. 7	2, 107, 494	993, 315	15. 7
Florida	5, 781, 000	2, 921, 700	98. 5	4, 838, 820	2, 540, 779	57. 5	7, 448, 526	3, 887, 100	131. 2	3, 987, 366	2, 165, 527	82. 4
Georgia	8, 792, 225	4, 461, 953	86. 7	3, 684, 045	1, 818, 969	27. 5	12, 335, 003	6, 289, 574	146. 4	13, 692, 415	6, 575, 007	132. 3
Idaho	4, 945, 000	3, 140, 828	94. 2	1, 076, 524	658, 231	38. 5	5, 516, 848	2, 913, 555	141. 6	3, 574, 389	2, 143, 740	94. 0
Illinois	9, 219, 400	4, 723, 910	106. 2	5, 801, 258	2, 902, 215	105. 8	25, 692, 891	13, 151, 668	333. 6	8, 038, 048	4, 098, 412	110. 1
Indiana	20, 051, 487	10, 167, 781	119. 0	5, 635, 768	2, 820, 839	136. 9	5, 839, 473	2, 932, 882	27. 1	3, 895, 450	2, 329, 364	8. 1
Iowa	1, 511, 300	251, 270	57. 1	2, 112, 477	980, 664	43. 0	12, 821, 584	6, 399, 863	309. 5	12, 048, 373	6, 014, 438	276. 8
Kansas	1, 998, 696	723, 898	61. 4	4, 437, 891	2, 227, 139	137. 6	8, 488, 937	4, 248, 761	186. 0	12, 039, 633	5, 953, 338	338. 2
Kentucky	7, 415, 368	3, 844, 184	89. 5	2, 754, 984	1, 379, 492	48. 5	9, 260, 428	4, 578, 811	108. 9	5, 801, 758	2, 886, 900	84. 6
Louisiana	10, 951, 078	5, 350, 439	67. 0	3, 867, 502	1, 927, 540	30. 0	10, 012, 170	5, 035, 193	101. 6	3, 982, 830	2, 136, 518	53. 0
Maine	1, 988, 000	1, 099, 350	21. 5	381, 300	190, 650	3. 2	3, 603, 257	1, 975, 699	29. 9	1, 704, 030	837, 814	14. 6
Maryland	2, 953, 620	1, 476, 810	10. 8	1, 030, 070	508, 535	. 5	7, 069, 325	3, 591, 477	24. 6	4, 381, 768	2, 188, 169	16. 5
Massachusetts	8, 417, 014	2, 615, 133	11. 4	244, 144	122, 072	---	6, 509, 642	3, 240, 222	5. 6	1, 237, 221	598, 888	4. 9
Michigan	10, 005, 000	5, 002, 500	148. 7	3, 159, 960	1, 578, 730	40. 3	9, 263, 098	5, 049, 212	131. 3	6, 992, 754	2, 955, 913	110. 5
Minnesota	871, 352	481, 231	15. 1	1, 405, 691	881, 263	51. 6	16, 534, 040	8, 090, 310	321. 1	8, 765, 608	4, 416, 427	318. 7
Mississippi	2, 436, 938	1, 266, 169	81. 7	4, 760, 688	2, 745, 514	102. 7	6, 989, 550	3, 483, 436	187. 6	3, 148, 899	1, 569, 342	133. 7
Missouri	9, 743, 548	4, 886, 422	72. 9	6, 166, 111	3, 056, 805	100. 5	18, 086, 024	9, 267, 611	177. 7	6, 297, 461	3, 523, 301	97. 1
Montana	9, 538, 209	5, 737, 903	178. 6	3, 244, 171	1, 905, 365	62. 0	8, 992, 303	5, 423, 808	149. 8	7, 405, 263	4, 518, 808	205. 5
Nebraska	6, 453, 700	3, 287, 050	220. 8	2, 171, 707	1, 076, 195	42. 5	9, 172, 171	4, 430, 375	309. 0	4, 721, 954	2, 369, 151	119. 3
Nevada	4, 120, 386	3, 431, 507	96. 2	65, 621	63, 729	. 1	1, 321, 470	1, 094, 155	50. 0	2, 522, 852	2, 005, 657	70. 1
New Hampshire	887, 699	430, 349	6. 2	---	---	---	3, 320, 934	1, 649, 753	23. 1	1, 644, 866	799, 642	12. 1
New Jersey	1, 761, 000	880, 500	5. 7	2, 808, 746	1, 390, 058	2. 1	5, 249, 600	2, 585, 132	10. 6	378, 775	179, 377	1. 9
New Mexico	2, 000, 000	1, 280, 400	31. 6	7, 390, 203	3, 597, 881	149. 8	4, 883, 984	3, 120, 370	72. 9	3, 455, 758	2, 285, 018	60. 9
New York	8, 107, 556	4, 558, 778	63. 6	---	---	---	34, 503, 942	15, 884, 013	130. 6	10, 798, 345	6, 389, 606	31. 6
North Carolina	7, 106, 177	3, 500, 827	160. 4	2, 333, 520	1, 074, 355	35. 5	15, 510, 773	7, 533, 694	206. 4	5, 131, 646	2, 621, 212	108. 6
North Dakota	3, 666, 277	1, 967, 713	149. 4	3, 134, 894	1, 572, 191	170. 6	3, 986, 436	1, 989, 397	231. 1	6, 703, 478	3, 338, 341	243. 9

Ohio	6,261,306	2,611,433	37.2	2,558,904	1,281,085	16.1	37,130,259	19,111,065	201.3	14,663,073	7,164,343	76.1
Oklahoma	7,584,336	3,379,805	96.3	2,045,690	1,170,035	44.7	13,044,692	6,937,351	172.8	8,261,415	4,333,762	151.5
Oregon	1,763,000	1,081,000	12.4	1,738,222	888,701	24.0	6,682,362	3,614,495	63.2	6,109,602	3,230,701	67.2
Pennsylvania	13,136,398	6,840,199	17.9	2,905,336	1,452,668	9.4	17,290,896	8,623,547	56.7	9,183,183	4,581,659	43.8
Rhode Island	276,000	138,000	.5	236,529	158,023		482,306	241,153		32,906	16,453	
South Carolina	9,216,012	4,808,609	70.9	1,254,070	622,500	19.5	3,875,109	2,089,606	32.9	3,833,679	1,970,314	43.8
South Dakota	2,770,339	1,582,628	104.8	3,348,510	1,846,692	102.7	5,546,414	3,367,323	279.0	4,405,396	2,636,032	275.4
Tennessee	5,923,620	2,883,810	25.4	3,057,326	1,528,663	27.0	10,010,682	4,761,227	84.6	5,578,048	2,682,211	58.8
Texas	8,739,700	3,931,250	33.5	7,470,712	3,749,730	146.4	17,314,450	9,062,215	281.6	20,546,447	10,116,687	412.9
Utah	2,439,177	1,886,783	25.3	928,715	671,190	11.0	2,905,165	2,128,810	54.8	2,716,400	1,918,635	52.2
Vermont	2,455,736	1,351,368	37.0	39,984	20,292		3,046,303	1,487,808	11.9	1,169,914	573,513	19.4
Virginia	7,843,626	3,972,139	88.6	6,556,707	3,265,946	123.3	9,106,968	4,526,947	88.5	7,266,011	3,993,088	62.4
Washington	4,533,500	2,302,500	51.5	1,696,127	867,860	18.2	7,190,277	3,112,023	42.6	6,311,348	2,772,302	82.9
West Virginia	5,867,546	2,919,093	45.4	1,395,765	697,883	4.8	3,440,340	1,704,020	20.8	1,942,688	990,715	10.4
Wisconsin	10,480,672	5,827,636	163.0	3,932,249	1,861,708	61.4	8,609,304	4,215,097	167.8	10,624,395	5,323,799	177.3
Wyoming	725,000	443,093	11.8	300,339	194,979	2.0	6,915,402	4,287,862	145.1	3,501,714	2,305,150	115.8
Hawaii	4,262,350	1,932,745	8.4	106,674	53,197		2,928,464	1,449,262	15.3	1,495,352	723,875	15.0
Puerto Rico	2,805,740	1,294,170	12.4	727,933	324,217	2.7	3,031,834	1,433,799	12.1	1,575,427	698,161	2.8
Total	285,735,616	140,497,353	3,313.1	126,165,108	64,032,181	2,177.4	466,400,749	239,076,424	5,803.5	287,481,686	149,474,702	4,849.7

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[1] Includes projects on rural portions of the Federal-aid highway system financed from Federal-aid primary, prewar Federal-aid primary and grade crossing, emergency highway and grade crossing, Defense Highway Act, and 1950 access funds.

[2] Initial commitment of funds.

Table 9.—*Status of projects as of June 30, 1951, and projects completed during the fiscal year,*[1] *on secondary roads in rural areas*

State or Territory	Programed,[2] plans not approved			Plans approved, not under construction			Under construction			Completed during fiscal year		
	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles
Alabama	$5, 157, 512	$2, 540, 186	294. 2	$2, 750, 962	$1, 375, 481	122. 8	$5, 154, 621	$2, 401, 891	291. 2	$4, 911, 807	$2, 368, 129	348. 5
Arizona	2, 792, 359	1, 970, 610	99. 1	10, 280	8, 861	-----	293, 047	203, 276	8. 4	3, 746, 933	2, 582, 981	124. 1
Arkansas	3, 631, 750	1, 822, 805	232. 9	2, 118, 264	1, 074, 373	112. 1	4, 633, 470	2, 313, 153	204. 5	6, 004, 773	2, 995, 009	248. 2
California	7, 565, 634	4, 105, 539	146. 9	3, 582, 888	1, 921, 558	55. 8	6, 293, 435	3, 123, 309	142. 7	6, 642, 647	3, 311, 458	117. 4
Colorado	2, 081, 164	1, 178, 014	78. 0	917, 409	520, 930	59. 2	2, 867, 292	1, 658, 323	145. 5	5, 582, 760	3, 119, 423	260. 3
Connecticut	717, 324	358, 662	2. 6	688, 392	343, 799	. 5	511, 476	252, 164	3. 2	571, 917	282, 940	1. 9
Delaware	992, 000	588, 500	22. 5	10, 000	9, 000	-------	1, 510, 182	723, 655	8. 1	2, 451, 290	1, 180, 577	64. 8
Florida	3, 808, 300	1, 881, 250	178. 2	1, 057, 019	505, 090	51. 8	5, 676, 598	2, 376, 436	263. 3	4, 723, 392	2, 138, 833	186. 6
Georgia	1, 114, 950	643, 555	53. 6	1, 215. 878	642, 683	39. 0	10, 642, 563	5, 526, 713	518. 3	8, 939, 412	4, 452, 364	469. 1
Idaho	3. 596, 550	2, 295, 743	245. 2	916, 290	584, 013	49. 3	2, 490, 700	1, 610, 608	136. 0	1, 834, 233	1, 060, 755	122. 3
Illinois	5, 107, 620	2, 453, 567	204. 2	1. 930, 350	935, 175	82. 1	4, 658, 138	2, 325, 526	119. 9	4, 724, 385	2, 319, 348	184. 6
Indiana	6, 493, 578	3, 242, 332	82. 7	2, 024, 828	866, 923	30. 6	5, 272, 542	2, 363, 590	52. 9	2, 986, 871	1, 438, 382	34. 7
Iowa	4, 885, 471	2, 454, 583	318. 8	4, 950, 666	2, 485, 155	381. 4	3, 397, 659	1, 693, 211	270. 4	7, 689, 542	3, 759, 801	805. 5
Kansas	4. 556, 974	2, 234, 007	1, 121. 5	1, 133, 649	567, 859	166. 0	3, 230, 414	1, 599, 836	327. 5	5, 652, 269	2, 831, 998	1, 193. 6
Kentucky	8, 534, 594	4, 383, 797	212. 5	857, 846	695, 907	21. 5	6, 334, 402	3, 154, 209	161. 2	6, 686, 051	3, 275, 476	204. 1
Louisiana	2, 504, 432	1, 000, 516	33. 6	3, 047, 397	1, 517. 176	25. 4	6, 896, 959	3, 544, 324	97. 6	7, 494, 469	3, 631, 564	150. 6
Maine	4, 143, 150	2, 916, 165	49. 7	303, 201	109, 011	2. 0	2, 508, 418	1, 387, 548	31. 7	3, 009, 776	1, 486, 104	59. 8
Maryland	624, 288	317, 584	15. 1	669, 931	334, 589	42. 9	1, 532, 946	832, 587	23. 7	1, 594, 695	701, 343	48. 5
Massachusetts	1, 774, 610	1, 017, 305	15. 2	279, 288	139, 469	1. 2	1, 330, 775	624, 296	7. 9	1, 416, 138	795, 088	8. 9
Michigan	8, 047, 250	4, 065, 785	418. 0	2, 826, 714	1, 418, 468	210. 7	5, 786, 273	2, 888, 587	208. 6	5, 684, 024	2, 845, 811	350. 5
Minnesota	4, 896, 148	2, 475, 339	938. 7	5, 314, 850	2, 715, 436	601. 5	3. 797, 427	1, 875, 011	401. 2	6, 100, 845	3, 023, 681	1, 003. 7
Mississippi	1, 361, 216	662, 693	71. 0	3, 130, 374	1, 552, 237	116. 1	4, 979, 233	2, 528, 417	177. 4	3, 232, 744	1, 616, 490	162. 0
Missouri	7, 109, 951	3, 569, 775	675. 3	4, 314, 145	2, 310, 578	284. 9	3, 319, 470	1, 658, 923	366. 9	5, 831, 895	2, 912, 268	640. 0
Montana	6, 454, 322	3, 797, 642	344. 8	1, 942, 984	1, 104, 593	90. 1	2, 918, 552	1, 657, 736	110. 5	3, 307, 983	1, 894, 664	266. 2
Nebraska	4, 852, 316	2, 715, 008	232. 8	1, 685, 568	866, 683	55. 2	5, 470, 146	2, 764, 839	213. 9	3, 646, 920	1, 843, 279	128. 2
Nevada	1, 457, 248	1, 225, 112	77. 6	439, 707	369. 498	33. 8	1, 447, 439	1, 194, 503	72. 5	2, 434, 898	1, 929, 694	147. 2
New Hampshire	750, 800	377, 900	7. 2	396, 090	173, 957	5. 7	1, 835, 830	909, 711	24. 2	1, 093, 158	541, 471	14. 6
New Jersey	1, 882, 000	930, 500	13. 6	660, 006	330, 003	---------	316, 749	145, 097	. 2	2, 593, 396	1, 118, 521	10. 4
New Mexico	1, 612, 792	1, 034, 710	90. 8	235, 991	154, 251	9. 0	2, 795, 395	1, 892, 839	143. 4	5, 855, 213	3, 728, 063	336. 7
New York	11, 466, 240	5, 960, 620	114. 8	2, 009, 182	924, 734	19. 0	6, 332, 795	2, 876, 468	63. 3	5, 788, 329	2, 842, 958	50. 3
North Carolina	6, 046, 475	3, 063, 375	225. 8	1, 703, 460	818, 105	73. 2	9, 036, 747	4, 522, 055	386. 6	7, 658, 501	3, 831, 151	354. 4
North Dakota	6. 993, 184	3, 481, 202	1, 501. 0	3, 890, 233	1, 933, 347	297. 3	3, 685, 265	1, 838, 617	387. 3	4, 419, 067	2, 265, 336	664. 5

Ohio	13, 584, 248	6, 799, 935	222. 0	2, 123, 627	1, 116, 978	145. 6	8, 080, 610	4, 120, 726	105. 1	5, 021, 293	2, 424, 508	133. 9
Oklahoma	5, 113, 300	2, 087, 093	157. 7	2, 121, 695	1, 165, 107	73. 6	6, 856, 656	2, 905, 817	212. 7	9, 040, 655	4, 090, 526	426. 1
Oregon	880, 000	546, 500	20. 1	1, 703, 504	984, 366	71. 4	6, 340, 119	3, 632, 450	151. 6	3, 422, 841	1, 956, 485	110. 1
Pennsylvania	4, 300, 800	2, 143, 400	35. 0	3, 806, 594	1, 901, 132	40. 8	13, 554, 108	6, 627, 662	135. 5	5, 038, 048	2, 512, 255	49. 8
Rhode Island	3, 419, 674	1, 709, 837	43. 9	167, 686	83, 843	1. 1	912, 594	443, 252	5. 1	122, 344	59, 542	2. 1
South Carolina	2, 362, 683	1, 189, 162	188. 5	506, 945	236, 200	33. 8	5, 347, 322	3, 961, 940	195. 0	5, 312, 699	2, 601, 628	495. 6
South Dakota	4, 842, 764	2, 884, 271	646. 4	2, 231, 686	1, 209, 744	188. 8	4, 894, 404	2, 789, 843	381. 1	4, 223, 610	2, 438, 665	620. 4
Tennessee	4, 843, 456	2, 449, 078	246. 2	3, 251, 876	1, 625, 938	171. 1	5, 560, 114	2, 753, 007	250. 6	6, 057, 308	2, 943, 182	384. 9
Texas	1, 434, 100	633, 210	46. 0	733, 219	409, 235	32. 0	6, 818, 238	3, 428, 500	337. 3	21, 531, 142	10, 725, 562	1, 783. 6
Utah	2, 119, 868	1, 574, 951	77. 7	340, 415	255, 494	27. 6	3, 288, 526	2, 565, 486	147. 2	1, 770, 889	1, 291, 139	88. 7
Vermont	1, 898, 372	954, 339	23. 3	782, 251	391, 312	6. 2	1, 463, 890	727, 110	19. 8	632, 559	309, 504	10. 5
Virginia	8, 261, 815	4, 173, 185	417. 4	4, 572, 616	2, 293, 436	147. 5	5, 947, 150	3, 555, 804	187. 8	7, 576, 605	3, 756, 744	303. 9
Washington	2, 209, 368	1, 097, 182	122. 5	2, 262, 157	1, 071, 059	83. 4	6, 938, 612	3, 435, 401	84. 2	4, 184, 818	2, 084, 280	121. 0
West Virginia	4, 109, 230	2, 112, 978	78. 2	2, 404, 375	1, 207, 337	53. 5	2, 845, 066	1, 517, 108	74. 7	2, 922, 191	1, 470, 515	48. 5
Wisconsin	6, 808, 635	3, 388, 660	383. 3	2, 349, 092	1, 105, 200	132. 7	5, 822, 843	2, 727, 608	270. 9	5, 222, 741	2, 486, 463	321. 2
Wyoming	1, 119, 000	727, 458	35. 3	1, 617, 121	1, 049, 902	58. 3	2, 252, 199	1, 463, 166	131. 1	2, 456, 828	1, 557, 433	185. 3
Hawaii	3, 876, 564	1, 808, 647	6. 7	19, 490	9, 745	----------	1, 110, 501	434, 628	6. 8	1, 041, 576	519, 788	6. 9
Puerto Rico	3, 304, 181	1, 606, 091	31. 8	834, 111	393, 444	8. 4	1, 198, 303	563, 626	9. 6	2, 501, 255	1, 081, 452	20. 3
Total	207, 500, 260	108, 683, 358	10, 899. 9	88, 872, 302	45, 848, 414	4, 315. 9	216, 168, 213	112, 120, 592	8, 076. 1	232, 389, 735	118, 434, 631	13, 875. 0

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[1] Includes projects on secondary roads in rural areas financed from Federal-aid secondary, prewar Federal-aid secondary and grade crossing, emergency highway and grade crossing, Defense Highway Act, and 1950 access funds.

[2] Initial commitment of funds.

Table 10.—*Status of projects as of June 30, 1951, and projects completed during the fiscal year,*[1] *in urban areas*

State or Territory	Programed,[2] plans not approved			Plans approved, not under construction			Under construction			Completed during fiscal year		
	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles
Alabama	$1,154,800	$536,400	1.4	$1,997,630	$1,038,855	7.0	$3,330,004	$1,546,338	15.5	$1,092,849	$964,530	0.6
Arizona	1,000,000	709,000	5.4	703,042	402,393	9.7	453,471	320,341	3.1	5,529	3,493	
Arkansas	980,000	803,550	1.0	155,756	61,878		1,673,555	789,735	19.5	1,524,921	721,976	30.4
California	17,566,802	1,577,550	8.6	11,142,031	5,535,696	6.6	34,579,819	16,896,896	45.4	3,347,858	1,731,671	13.4
Colorado	65,979	30,090	.4	882,613	441,999	1.5	3,253,582	1,583,498	3.5	5,354,822	3,319,961	15.3
Connecticut	3,996,071	1,998,031	10.3	1,860,478	1,116,727	2.7	5,323,946	2,771,674	3.4	5,909,865	3,036,003	8.1
Delaware							568,713	252,863	2.3	203,814	92,291	2.7
Florida	3,345,000	1,815,000	15.9	1,867,456	1,035,166	7.9	6,919,564	3,597,659	23.5	1,045,785	458,562	22.0
Georgia	1,580,000	790,000	1.9	4,821,631	1,515,304	1.8	9,607,181	4,865,007	15.6	4,308,964	2,157,654	4.1
Idaho				284,694	173,549	.1	482,356	354,993	2.2	1,156,742	767,877	.3
Illinois	19,864,514	11,457,612	13.9	11,506,065	5,820,442	24.1	38,615,173	20,056,492	96.5	17,097,585	7,400,489	10.8
Indiana	10,671,162	5,222,736	20.8	1,208,421	617,791	14.5	6,324,830	3,554,984	16.4	2,632,578	1,287,306	6.7
Iowa	3,166,646	1,683,323	17.0	2,004,398	987,522	10.5	3,696,796	2,232,882	16.9	2,355,273	1,299,894	8.2
Kansas	1,329,516	794,755	.6	558,724	279,362	3.3	1,308,328	649,164	3.7	2,838,895	1,619,501	16.2
Kentucky	6,246,265	3,242,132	28.0	291,202	117,101	2.1	1,460,409	730,204	5.8	1,421,435	770,866	20.6
Louisiana	2,207,822	1,078,911	5.3	1,590,368	549,630	10.1	1,114,150	573,040	2.4	5,871,778	3,402,255	22.1
Maine	1,513,504	846,752	.7	132,881	67,713	.8	1,864,963	905,762	8.6	471,860	235,743	2.4
Maryland	114,000	57,000	1.5	3,760,212	2,335,856	2.4	3,964,800	1,605,921	6.4	5,563,052	2,853,277	2.2
Massachusetts	5,232,314	1,598,107	7.9	5,321,684	1,979,167	.4	62,475,106	31,140,804	45.7	6,212,373	3,177,007	6.0
Michigan	5,612,286	2,806,168	4.5	4,911,250	2,082,830	9.3	33,803,594	13,348,887	23.7	10,864,395	5,224,511	24.4
Minnesota	828,960	595,640	3.9	1,984,468	1,412,064	6.6	6,536,098	4,129,992	13.2	5,029,362	2,794,228	23.7
Mississippi	395,994	197,997		1,664,106	832,053	8.2	1,154,600	577,300	9.0	1,774,072	1,088,798	27.2
Missouri	7,807,694	4,269,587	4.7	5,018,104	2,508,186	16.5	12,519,727	6,889,615	8.5	4,138,302	2,208,540	16.4
Montana	752,186	640,419	.8	7,190	4,100		1,706,570	1,106,450	2.4	722,138	547,947	2.6
Nebraska	1,265,800	638,200	5.1	1,210,930	537,355	1.0	2,204,694	1,562,953	2.1	2,059,199	1,527,350	1.4
Nevada	64,150	53,046	.3	40,898	34,411	1.0	524,585	433,490	8.4	473,426	373,060	2.4
New Hampshire	1,081,500	725,500	5.5	22,375	11,187		519,564	259,464	2.5	589,731	291,893	2.1
New Jersey	8,640,000	4,320,000	3.2	6,038,024	3,019,012	.8	9,892,281	4,572,291	12.8	11,872,563	5,721,669	14.9
New Mexico	60,600	38,663	.2	1,180,317	754,484	15.8	3,049,459	1,945,555	13.8	1,193,822	772,943	12.3
New York	56,037,770	29,066,635	55.5	9,424,869	4,273,633	24.2	72,132,281	34,236,426	56.2	35,281,027	16,231,074	24.7
North Carolina	2,994,102	1,445,602	7.4	973,050	486,525	8.2	4,554,223	2,098,040	32.2	6,111,939	2,762,984	37.9
North Dakota	415,800	207,900	2.3	12,708	6,354		128,600	64,340		725,355	339,766	17.1

Ohio	11,638,050	5,178,575	17.0	650,786	320,539	1.7	37,447,211	18,757,342	36.2	1,830,219	883,565	5.2
Oklahoma	3,865,000	2,153,162	18.6	1,782,315	971,038	4.9	4,444,924	2,472,443	7.3	1,644,952	870,123	7.7
Oregon	775,000	432,000	1.0	622,036	356,526	1.4	3,365,418	1,899,410	3.1	2,834,301	1,560,912	9.9
Pennsylvania	280,322	140,161		8,774,974	4,385,619	2.6	55,784,114	27,452,360	39.8	22,264,765	11,057,843	5.4
Rhode Island	1,916,916	958,458	1.3	645,662	322,731	1.5	13,375,851	6,819,092	12.0	1,643,681	872,911	7.1
South Carolina	417,621	195,216	2.2	360,930	184,630	1.3	4,261,684	2,211,476	21.6	1,034,120	444,296	2.1
South Dakota	511,827	287,409	3.4				758,969	603,639	11.0	220,470	128,023	.9
Tennessee	1,777,460	813,730	1.9	2,291,584	878,292	.5	8,773,606	4,025,491	8.3	2,625,284	1,148,378	1.0
Texas	1,080,000	540,000	2.2	9,832,766	5,015,974	19.8	25,195,425	10,848,926	157.3	12,473,067	6,312,400	59.6
Utah	478,000	351,916	6.6	30,234	24,614	.9	60,618	38,290		1,063,494	786,062	10.4
Vermont	281,934	157,467	1.4	20,347	15,454		150,303	75,312	.7	166,207	86,815	1.1
Virginia	3,295,061	1,406,002	12.3	701,845	345,676	4.2	1,332,814	617,188	4.2	3,665,956	1,732,195	6.9
Washington	3,286,156	595,765	.4	640,785	316,135	4.1	7,845,195	4,173,491	5.4	2,573,530	1,351,836	2.2
West Virginia	1,889,726	1,444,863	.5	491,300	245,650	1.8	3,063,621	1,518,587	4.3	2,992,166	1,452,277	9.0
Wisconsin	3,739,962	2,330,681	9.2	4,896,846	2,293,661	9.1	5,317,408	2,809,075	43.8	2,599,401	1,344,777	17.4
Wyoming	200,000	129,840	1.3	58,409	42,109		195,254	126,334		255,102	165,532	2.0
District of Columbia	2,864,240	1,432,120	.7	2,964,790	1,482,300	3.2	1,175,296	780,389		1,071,181	530,913	3.6
Hawaii	149,860	68,930	.2	1,030,486	315,243	.5	5,401,920	1,662,635	1.7			
Puerto Rico	4,390,107	2,001,655	2.6	2,503,125	1,243,777	3.3	4,551,259	1,913,031	14.3	1,746,492	444,724	3.4
Total	208,828,479	99,864,256	316.8	120,876,795	58,798,313	257.9	518,243,912	254,457,571	892.2	211,955,697	106,358,701	554.1

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[1] Includes projects in urban areas financed from Federal-aid primary, secondary, and urban, prewar Federal-aid primary, secondary, and grade crossing, emergency highway and grade crossing, Defense Highway Act, and 1950 access funds.

[2] Initial commitment of funds.

Table 11.—*Interstate system improvements financed with postwar Federal-aid funds: Status of projects as of June 30, 1951, and projects completed during the fiscal year*

State or Territory	Programed,[1] plans not approved			Plans approved, not under construction			Under construction			Completed during fiscal year		
	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles
Alabama	$3, 699, 800	$1, 918, 900	30. 6	$741, 500	$305, 250	0. 2	$5, 294, 538	$2, 636, 058	34. 8	$1, 772, 898	$1, 297, 219	21. 4
Arizona	3, 020, 000	2, 152, 739	39. 7	499, 003	266, 000	8. 0	2, 942, 744	2, 109, 345	40. 3	2, 985, 979	2, 104, 894	52. 7
Arkansas	2, 848, 800	1, 427, 200	60. 8	1, 511, 820	750, 910	28. 2	2, 004, 462	1, 170, 642	11. 9	1, 190, 510	591, 116	25. 0
California	19, 840, 000	1, 473, 378	23. 4	5, 917, 500	3, 004, 552	12. 0	40, 720, 700	20, 314, 215	100. 9	8, 221, 054	4, 238, 200	48. 5
Colorado	896, 541	507, 442	12. 6	2, 590, 002	1, 408, 381	25. 0	5, 024, 884	2, 586, 090	28. 8	5, 481, 251	3, 224, 831	47. 1
Connecticut	2, 220, 000	1, 110, 000	8. 1	1, 811, 938	1, 092, 696	5. 5	6, 097, 537	2, 937, 765	3. 0	2, 730, 988	1, 352, 737	3. 3
Delaware	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
Florida	4, 793, 000	2, 380, 500	43. 1	1, 224, 676	711, 371	17. 0	5, 816, 640	3, 157, 183	68. 9	490, 311	228, 277	24. 7
Georgia	3, 965, 626	1, 965, 413	24. 0	5, 794, 226	2, 068, 023	16. 3	11, 271, 918	5, 209, 120	25. 6	5, 281, 744	2, 287, 033	8. 3
Idaho	1, 994, 000	1, 247, 491	34. 1	280, 064	170, 727	. 1	1, 523, 824	987, 883	43. 3	527, 617	346, 951	12. 3
Illinois	16, 202, 400	8, 939, 950	39. 7	8, 048, 100	3, 961, 300	4. 4	39, 731, 046	20, 754, 570	146. 4	16, 231, 693	6, 873, 790	22. 5
Indiana	11, 557, 350	5, 519, 875	34. 4	928, 738	467, 424	. 7	4, 552, 512	2, 677, 603	14. 5	3, 376, 828	2, 065, 367	6. 7
Iowa	----------	----------	----------	872, 148	428, 254	4. 6	116, 158	58, 075	----------	----------	----------	----------
Kansas	171, 000	85, 500	2. 1	837, 282	418, 641	11. 6	2, 622, 182	1, 311, 141	48. 7	3, 195, 081	1, 594, 600	46. 7
Kentucky	4, 415, 000	2, 225, 000	41. 7	1, 315, 938	659, 969	28. 1	4, 216, 962	2, 108, 481	53. 8	2, 621, 451	1, 305, 165	28. 8
Louisiana	3, 724, 400	1, 737, 300	10. 7	2, 032, 340	751, 170	10. 0	4, 470, 340	2, 235, 170	38. 6	5, 421, 200	3, 160, 600	25. 1
Maine	1, 509, 000	843, 000	. 7	----------	----------	----------	1, 849, 110	954, 640	15. 0	1, 091, 609	534, 983	9. 5
Maryland	1, 900, 000	950, 000	5. 1	3, 501, 000	2, 273, 000	. 9	4, 226, 600	2, 003, 500	6. 2	7, 353, 474	3, 752, 114	7. 7
Massachusetts	8, 350, 000	2, 581, 629	11. 4	----------	----------	----------	22, 508, 157	10, 838, 307	9. 4	3, 952, 388	1, 862, 024	7. 1
Michigan	6, 342, 286	3, 171, 168	4. 9	4, 276, 950	1, 764, 430	1. 2	32, 139, 982	12, 644, 902	23. 2	9, 631, 017	4, 699, 171	30. 9
Minnesota	838, 500	419, 250	15. 8	563, 799	401, 400	. 5	2, 654, 775	1, 287, 832	49. 0	901, 357	536, 846	4. 0
Mississippi	434, 000	217, 000	4. 8	2, 482, 300	1, 609, 100	35. 7	1, 395, 750	691, 300	11. 0	952, 300	675, 600	5. 0
Missouri	10, 254, 526	5, 326, 013	27. 4	5, 590, 383	2, 270, 769	19. 7	18, 515, 193	9, 505, 948	83. 4	4, 010, 052	2, 113, 998	43. 5
Montana	4, 635, 500	3, 057, 698	57. 7	1, 424, 300	808, 938	21. 3	3, 764, 904	2, 173, 418	54. 6	3, 874, 026	2, 327, 137	48. 1
Nebraska	378, 000	189, 000	15. 3	10, 300	3, 550	----------	648, 284	324, 142	6. 2	20, 703	12, 197	----------
Nevada	2, 670, 000	2, 215, 570	56. 0	65, 621	63, 729	. 1	528, 497	437, 012	17. 4	536, 507	436, 291	13. 1
New Hampshire	653, 500	512, 500	2. 1	5, 000	2, 500	----------	35, 000	19, 500	----------	678, 564	337, 604	4. 0
New Jersey	3, 096, 000	1, 548, 000	4. 6	2, 709, 270	1, 340, 320	2. 4	5, 803, 300	2, 774, 260	6. 5	1, 662, 874	820, 624	1. 8
New Mexico	450, 000	288, 090	6. 5	1, 961, 419	1, 255, 701	27. 2	6, 232, 531	3, 979, 774	70. 1	2, 860, 648	1, 892, 111	37. 7
New York	17, 250, 000	8, 100, 000	15. 8	336, 695	158, 652	10. 5	26, 016, 001	11, 736, 214	70. 5	230, 000	104, 763	. 9
North Carolina	1, 070, 000	501, 330	7. 8	4, 900	2, 450	----------	2, 439, 186	1, 044, 236	19. 2	2, 538, 485	1, 198, 215	20. 2
North Dakota	1, 254, 900	629, 410	31. 1	14, 000	7, 000	----------	188, 600	94, 340	----------	2, 307, 804	1, 151, 758	45. 4

Ohio	4, 351, 000	1, 750, 000	5. 9	354, 800	177, 400		9, 395, 418	3, 874, 634	1. 6	1, 303, 860	625, 130	7. 6
Oklahoma	500, 000	266, 650	4. 0	504, 450	234, 022	1. 6	6, 949, 170	3, 788, 836	29. 5	796, 808	419, 928	8. 0
Oregon	275, 000	162, 000	2. 5	1, 370, 625	690, 000	21. 8	5, 885, 797	3, 286, 215	46. 4	5, 584, 335	2, 843, 106	23. 0
Pennsylvania	4, 265, 300	2, 132, 650	8. 0	2, 657, 100	1, 328, 550	9. 4	32, 189, 841	15, 463, 650	22. 9	27, 296, 338	13, 585, 392	27. 4
Rhode Island	1, 734, 000	867, 000	1. 3				2, 536, 351	1, 134, 735	3. 9	10, 000	5, 000	
South Carolina	3, 842, 000	2, 091, 000	30. 2	825, 600	412, 800	12. 0	1, 230, 570	642, 600	10. 5	1, 418, 730	654, 224	25. 1
South Dakota	288, 000	161, 654	13. 1	1, 312, 925	736, 943	17. 3	1, 351, 804	759, 302	58. 3	1, 073, 868	599, 806	20. 4
Tennessee	4, 632, 500	2, 249, 000	16. 7	4, 003, 906	1, 734, 453	23. 5	3, 314, 512	1, 555, 155	19. 4	2, 844, 214	1, 249, 713	1. 9
Texas	4, 698, 000	1, 849, 000	23. 3	9, 075, 578	4, 584, 300	38. 0	18, 949, 000	9, 401, 500	90. 8	13, 567, 782	6, 854, 000	112. 7
Utah	1, 058, 000	868, 940	7. 8	928, 715	671, 190	11. 0	1, 226, 205	904, 600	33. 5	1, 383, 517	998, 473	24. 1
Vermont	49, 000	24, 500	. 2	4, 000	3, 000		1, 000	500		143, 070	70, 990	1. 0
Virginia	2, 710, 570	1, 287, 285	17. 7	837, 353	417, 660	10. 6	2, 486, 123	1, 229, 306	14. 8	1, 819, 191	891, 016	12. 7
Washington	1, 473, 000	808, 900	10. 4	873, 457	434, 600	3. 2	2, 914, 950	1, 449, 600	12. 7	1, 902, 258	977, 350	12. 8
West Virginia	3, 790, 500	2, 375, 250	11. 6				486, 914	243, 457	1. 5	1, 705, 788	880, 819	6. 7
Wisconsin	1, 388, 000	834, 000	9. 9	398, 052	125, 000	3. 5	1, 177, 166	579, 000	14. 4	1, 688, 872	776, 000	17. 3
Wyoming	650, 000	412, 058	6. 7	324, 748	217, 332	2. 0	2, 738, 946	1, 781, 566	55. 0	1, 814, 951	1, 230, 777	53. 2
District of Columbia	1, 933, 554	966, 777	. 4									
Total	178, 072, 553	82, 347, 010	841. 7	80, 822, 521	40, 193, 457	445. 1	358, 186, 084	176, 857, 322	1, 516. 4	166, 483, 995	85, 787, 940	1, 005. 9

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[1] Initial commitment of funds.

Table 12.—*Federal funds paid by Bureau of Public Roads during fiscal year ended June 30, 1951, by program and by State*

State or Territory	Federal-aid funds			Prewar Federal-aid funds			Defense highway funds	Emergency funds 1933–35	Total
	Primary [1]	Secondary	Urban	Primary	Secondary	Grade crossing			
Alabama	$1, 692, 870	$2, 351, 392	$382, 757		$2	$217, 490	$26, 711		$4, 671, 222
Arizona	3, 541, 619	1, 966, 204	158, 748	$57, 629	71, 574	45, 806	9, 835		5, 851, 415
Arkansas	3, 843, 135	3, 046, 023	413, 435	9, 197		56, 682			7, 368, 472
California	7, 087, 380	3, 841, 736	5, 259, 899	238, 505		66, 248	217, 523		16, 711, 291
Colorado	3, 406, 550	2, 842, 432	1, 296, 484	91, 560		100, 000	−84		7, 736, 942
Connecticut	601, 346	368, 577	3, 107, 887			150, 640			4, 228, 450
Delaware	867, 126	1, 142, 709	5, 740		10, 868				2, 026, 443
Florida	3, 522, 812	2, 339, 544	995, 534	378	14, 454	33, 336			6, 906, 058
Georgia	3, 961, 060	4, 417, 120	1, 436, 035	403, 345	157, 310	172, 354	52, 587	$274, 153	10, 873, 964
Idaho	2, 882, 153	987, 919	67, 613				12, 199		3, 949, 884
Illinois	4, 760, 048	1, 721, 073	7, 945, 588			109, 530			14, 536, 239
Indiana	2, 395, 180	1, 694, 320	1, 663, 323			13, 580	16, 121		5, 782, 524
Iowa	5, 522, 839	3, 984, 269	1, 667, 891						11, 174, 999
Kansas	4, 720, 013	2, 639, 627	759, 107	189, 199	26, 527	21, 980	55, 598		8, 412, 051
Kentucky	3, 671, 309	2, 826, 903	786, 122			45, 993			7, 330, 327
Louisiana	4, 147, 818	3, 628, 466	874, 930	117, 267	3, 139	538, 303			9, 309, 923
Maine	1, 820, 302	1, 275, 364	445, 137	−3, 198		76, 752	192		3, 614, 549
Maryland	1, 555, 058	684, 905	1, 282, 668				94, 084		3, 616, 715
Massachusetts	4, 580, 543	1, 025, 333	13, 132, 410	16, 728	11, 200	624, 361			19, 390, 575
Michigan	4, 134, 008	2, 845, 345	3, 451, 088			92, 567	19, 550		10, 542, 558
Minnesota	5, 067, 366	3, 037, 702	2, 383, 260	10, 325	24, 618	144, 468	13, 270		10, 681, 009
Mississippi	2, 087, 913	1, 519, 294	490, 676	14, 167	1, 435	41, 442	128, 367		4, 283, 294
Missouri	6, 029, 357	2, 619, 028	1, 798, 516	39, 448		73, 069			10, 559, 418
Montana	4, 375, 528	2, 024, 963	347, 188	63, 267	67, 528	97, 341	65, 524		7, 041, 339
Nebraska	3, 493, 357	1, 651, 036	325, 407	15, 106	45, 543	375, 827	10, 347		5, 916, 623
Nevada	1, 697, 341	2, 198, 528	54, 618	27, 563	−5, 829	30, 235			4, 002, 456
New Hampshire	1, 069, 301	702, 063	189, 317	14, 245		4, 645			1, 979, 571
New Jersey	1, 744, 573	993, 366	3, 901, 513	5, 199	3, 396	329, 818			6, 977, 865
New Mexico	2, 841, 319	3, 302, 714	473, 871			108, 652	173, 807		6, 900, 363
New York	7, 351, 495	2, 054, 792	13, 830, 398	31, 963	2, 269	422, 075	21, 272		23, 714, 264
North Carolina	3, 819, 622	4, 060, 529	1, 333, 928	226, 167	10, 858	108, 068	90, 136		9, 649, 308
North Dakota	3, 198, 833	2, 240, 369	57, 130		55, 649	173, 712			5, 725, 693

Ohio	8, 997, 583	2, 603, 587	3, 195, 376	261, 654	370, 501	258, 224			15, 686, 925
Oklahoma	5, 050, 025	4, 624, 401	1, 224, 357	74, 358	28, 620	168, 537	13, 442		11, 183, 740
Oregon	3, 494, 545	1, 562, 440	598, 379		4, 847		70, 220		5, 730, 431
Pennsylvania	7, 835, 812	4, 762, 446	9, 292, 466	5, 294	31, 126	93, 463	28, 815		22, 049, 422
Rhode Island	1, 149, 920	263, 551	1, 377, 849	54, 744	3, 008	10, 655			2, 859, 727
South Carolina	1, 526, 124	2, 310, 097	540, 638	−2, 383		95, 202	1, 563, 060		6, 032, 738
South Dakota	2, 869, 620	2, 438, 432	163, 199	99, 559	570, 140	360, 573	22, 879		6, 524, 402
Tennessee	3, 182, 113	3, 165, 104	490, 744				87, 546		6, 925, 507
Texas	5, 232, 237	7, 281, 718	1, 012, 326			164, 891			13, 691, 172
Utah	2, 309, 599	1, 852, 412	275, 512			5, 859	85, 927		4, 529, 309
Vermont	731, 823	342, 180	128, 876	26, 939	711	4, 840			1, 235, 369
Virginia	3, 390, 101	2, 930, 407	1, 127, 272	59, 239		28, 158	271, 014		7, 806, 191
Washington	3, 326, 347	2, 632, 157	1, 196, 098			833	11, 830		7, 167, 265
West Virginia	1, 563, 213	1, 347, 483	453, 222			12, 788			3, 376, 706
Wisconsin	4, 255, 126	2, 778, 025	1, 529, 092			465, 680	57, 672		9, 085, 595
Wyoming	2, 531, 320	1, 475, 659	181, 953			7, 477			4, 196, 409
District of Columbia	259, 265	269, 652	21, 896		−381	31, 255			581, 687
Hawaii	1, 152, 334	151, 390	211, 871	49, 047					1, 564, 642
Puerto Rico	783, 460	453, 075	399, 914	42, 042	48, 228	8, 557			1, 735, 276
Total	171, 129, 741	115, 277, 861	93, 739, 258	2, 238, 553	1, 557, 341	5, 991, 966	[2] 3, 389, 928	274, 153	[2] 393, 598, 801

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[1] Funds available for either urban or rural portions of the Federal-aid highway system.

[2] Total shown includes $170,484 of expenditures made during the year but not distributed by States.

Table 13.—*Balances of Federal-aid funds available to States for projects not yet programed as of June 30, 1951*

State or Territory	Primary [1]	Secondary	Urban	Prewar	Total
Alabama	$9, 596, 573	$3, 126, 786	$3, 015, 929		$15, 739, 288
Arizona	391, 000	633, 361	230, 907		1, 255, 268
Arkansas	1, 097, 675	2, 114, 222	815, 894	$21	4, 027, 812
California	2, 449, 666	3, 853, 886	2, 861, 334		9, 164, 886
Colorado	1, 735, 672	1, 452, 551	397, 554		3, 585, 777
Connecticut	748, 582	1, 304, 137	1, 183, 194		3, 235, 913
Delaware	1, 256, 324	741, 632	775, 601		2, 773, 557
Florida	884, 707	1, 349, 528	2, 484, 645		4, 718, 880
Georgia	2, 967, 811	3, 840, 119	1, 356, 881	5, 348	8, 170, 159
Idaho	2, 315, 817	2, 678, 237	437, 439		5, 431, 493
Illinois	5, 172, 356	10, 516, 019	6, 200, 953		21, 889, 328
Indiana	1, 302, 395	6, 241, 698	4, 342, 804		11, 886, 897
Iowa	1, 462, 467	918, 918	1, 505, 062		3, 886, 447
Kansas	1, 203, 061	5, 146, 201	1, 192, 869		7, 542, 131
Kentucky	1, 048, 936	852, 521	926, 673	1, 725	2, 829, 855
Louisiana	1, 089, 135	827, 875	4, 264, 274	32, 980	6, 214, 264
Maine	1, 910, 150	1, 270, 807	808, 411		3, 989, 368
Maryland	519, 098	2, 352, 264	1, 685, 782		4, 557, 144
Massachusetts	615, 872	485, 303	1, 375, 612		2, 476, 787
Michigan	2, 746, 338	2, 723, 571	1, 214, 921		6, 684, 830
Minnesota	1, 267, 359	1, 827, 190	1, 543, 850		4, 638, 399
Mississippi	3, 458, 815	4, 887, 485	292, 474		8, 638, 774
Missouri	1, 801, 955	6, 184, 816	2, 299, 261		10, 286, 032
Montana	1, 183, 408	3, 779, 441	200, 119		5, 162, 968
Nebraska	3, 470, 274	4, 757, 467	1, 005, 910	108	9, 233, 759
Nevada	2, 209, 815	1, 328, 041	92, 960		3, 630, 816
New Hampshire	1, 208, 173	1, 139, 254	538, 855	280	2, 886, 562
New Jersey	1, 235, 715	1, 294, 498	2, 406, 847		4, 937, 060
New Mexico	872, 094	1, 847, 351	529, 149	138	3, 248, 732
New York	7, 082, 386	6, 492, 984	19, 587, 047		33, 162, 417
North Carolina	2, 028, 105	2, 057, 730	941, 096		5, 026, 931
North Dakota	837, 804	919, 226	493, 717		2, 250, 747
Ohio	1, 793, 344	3, 649, 414	9, 213, 457		14, 656, 215
Oklahoma	1, 243, 217	1, 320, 911	785, 386	290, 267	3, 639, 781
Oregon	90, 695	854, 177	292, 730		1, 237, 602
Pennsylvania	2, 684, 604	2, 124, 456	10, 109, 666		14, 918, 726
Rhode Island	903, 909	351, 643	800, 750		2, 056, 302
South Carolina	1, 124, 134	1, 337, 576	882, 423	694	3, 344, 827
South Dakota	787, 427	761, 677	650, 653		2, 199, 757
Tennessee	1, 093, 979	2, 390, 795	1, 153, 344		4, 638, 118
Texas	639, 422	8, 288, 926	1, 524, 633		10, 452, 981
Utah	680, 715	721, 986	1, 461, 278		2, 863, 979
Vermont	377, 567	274, 819	470, 054		1, 122, 440
Virginia	1, 637, 509	1, 233, 965	4, 195, 209		7, 066, 683
Washington	901, 946	1, 125, 461	1, 829, 175		3, 856, 582
West Virginia	2, 141, 312	1, 162, 654	425, 233	89, 718	3, 818, 917
Wisconsin	1, 710, 284	3, 238, 649	2, 886, 236		7, 835, 169
Wyoming	617, 095	417, 887	259, 526		1, 294, 508
District of Columbia	567, 947	1, 083, 119	1, 870, 312		3, 521, 378
Hawaii	404, 663	386, 329	472, 709	188, 075	1, 451, 776
Puerto Rico	1, 325, 995	1, 566, 210	168, 122		3, 060, 327
Total	87, 895, 302	121. 235, 773	106, 458. 920	609, 354	316, 199, 349

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[1] Funds available for either urban or rural portions of the Federal-aid highway system.

Table 14.—*Average number*[1] *of persons employed on Bureau of Public Roads and State highway construction and maintenance, United States and Territories, by program and by month, for the fiscal year ended June 30, 1951*

Year and month	Federal-aid programs	Prewar Federal-aid programs	Federal forests, parks, public lands, flood relief, and miscellaneous	Total Federal programs	State highways, with State funds only	Road maintenance by State highway departments	Total construction and maintenance
1950							
July	84,009	869	1,629	89,507	52,176	130,168	272,151
August	87,017	771	1,703	92,491	56,694	130,714	279,899
September	84,055	671	1,608	89,334	56,654	126,664	272,652
October	80,956	582	3,836	85,374	55,169	123,193	264,036
November	64,929	603	2,811	68,343	48,296	122,681	239,320
December	41,653	342	1,975	43,970	35,887	118,487	198,344
1951							
January	33,267	217	1,592	35,076	27,105	114,450	176,631
February	30,425	216	1,354	31,995	24,368	113,856	170,219
March	37,412	202	1,803	39,417	28,121	114,118	181,656
April	53,336	211	2,342	55,889	36,275	114,672	206,836
May	67,278	240	3,072	70,590	44,872	118,484	233,946
June	74,979	265	4,212	79,456	50,939	128,859	259,254

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[1] Average number of persons employed is computed as the mean of the weekly payroll counts made during the calendar month.

Table 15.—*Mileage of designated Federal-aid systems, by State, as of June 30, 1951*

State or Territory	Federal-aid highway system			Federal-aid secondary system
	Total	In rural areas PRIMARY	In urban areas URBAN	SECONDARY
	Miles	*Miles*	*Miles*	*Miles*
Alabama	5, 017	4, 805	212	10, 693
Arizona	2, 518	2, 446	72	2, 843
Arkansas	3, 470	3, 341	129	12, 968
California	7, 183	6, 448	735	9, 269
Colorado	4, 028	3, 923	105	3, 689
Connecticut	1, 109	816	293	1, 103
Delaware	528	501	27	1, 253
Florida	4, 309	3, 902	407	8, 230
Georgia	7, 109	6, 798	311	12, 426
Idaho	3, 474	3, 434	40	3, 170
Illinois	10, 329	9, 353	976	7, 425
Indiana	4, 830	4, 268	562	8, 968
Iowa	9, 676	9, 335	341	33, 035
Kansas	8, 388	8, 195	193	20, 782
Kentucky	3, 879	3, 676	203	10, 742
Louisiana	2, 676	2, 455	221	5, 596
Maine	1, 626	1, 544	82	2, 267
Maryland	1, 860	1, 668	192	5, 219
Massachusetts	2, 067	1, 075	992	2, 176
Michigan	6, 499	6, 016	483	14, 835
Minnesota	7, 397	6, 940	457	14, 673
Mississippi	4, 601	4, 439	162	7, 603
Missouri	8, 296	8, 068	228	12, 784
Montana	5, 868	5, 806	62	3, 098
Nebraska	5, 558	5, 441	117	10, 130
Nevada	2, 202	2, 177	25	2, 040
New Hampshire	1, 183	1, 065	118	1, 298
New Jersey	1, 733	1, 203	530	1, 911
New Mexico	4, 031	3, 950	81	4, 248
New York	10, 462	9, 055	1, 407	19, 058
North Carolina	7, 276	6, 928	348	10, 007
North Dakota	3, 277	3, 232	45	10, 419
Ohio	7, 625	6, 640	985	12, 321
Oklahoma	7, 414	7, 182	232	10, 615
Oregon	3, 932	3, 768	164	4, 534
Pennsylvania	7, 925	6, 694	1, 231	10, 706
Rhode Island	470	237	233	324
South Carolina	4, 523	4, 314	209	9, 873
South Dakota	4, 277	4, 202	75	11, 481
Tennessee	5, 038	4, 819	219	6, 967
Texas	15, 932	15, 317	615	20, 072
Utah	2, 263	2, 197	66	2, 905
Vermont	1, 238	1, 180	58	1, 781
Virginia	5, 133	4, 869	264	16, 595
Washington	3, 413	3, 231	182	6, 674
West Virginia	2, 392	2, 188	204	11, 007
Wisconsin	6, 076	5, 678	398	13, 765
Wyoming	3, 445	3, 401	44	1, 796
District of Columbia	144	----------	144	57
Hawaii	564	536	28	553
Puerto Rico	574	440	134	1, 005
Total	234, 837	219, 196	15, 641	416, 989

Table 16.—*Mileage of the National forest highway system, by forest road class and by State, as of June 30, 1951*

Region and State or Territory	Total	Class 1 [1]	Class 2 [2]	Class 3 [3]
Western region:	*Miles*	*Miles*	*Miles*	*Miles*
Arizona	1,059.2	406.1	384.0	269.1
California	2,466.0	678.0	305.5	1,482.5
Colorado	1,507.0	583.0	466.0	458.0
Idaho	1,129.8	690.8	76.9	362.1
Montana	1,190.5	694.3	173.9	322.3
Nevada	313.7	157.2	130.8	25.7
New Mexico	655.0	160.0	292.0	203.0
Oregon	1,381.8	716.8	350.6	314.4
South Dakota	302.0	189.0	101.0	12.0
Utah	690.0	187.0	216.0	287.0
Washington	755.8	387.7	80.5	287.6
Wyoming	535.0	396.0	109.0	30.0
Alaska	387.9			387.9
Total	12,373.7	5,245.9	2,686.2	4,441.6
Eastern region:				
Alabama	250.9	105.9	112.6	32.4
Arkansas [4]	633.6	111.6	522.0	
Florida	165.0	33.0	105.9	26.1
Georgia	349.7	153.4	147.9	48.4
Illinois	306.8	245.8	30.5	30.5
Indiana	101.2	53.6	47.6	
Kentucky	352.9	131.1	180.3	41.5
Louisiana	402.3	54.1	94.4	253.8
Maine	14.0			14.0
Michigan	1,169.6	582.1	488.6	98.9
Minnesota	718.8	256.5	292.3	170.0
Mississippi	507.4	239.3	239.5	28.6
Missouri	985.7	379.7	471.3	134.7
Nebraska	29.8		12.0	17.8
New Hampshire	166.0	40.9	60.6	64.5
North Carolina	792.4	382.0	326.5	83.9
Ohio	133.6	70.4	34.1	29.1
Oklahoma [4]	48.5	31.5	17.0	
Pennsylvania	353.9	123.7	36.7	193.5
South Carolina	377.7	230.9	146.8	
Tennessee	348.3	165.1	148.9	34.3
Texas [4]	307.2	129.2	170.5	7.5
Vermont	119.1	32.7	61.9	24.5
Virginia [4]	1,351.1	399.9	773.6	177.6
West Virginia [4]	484.1	78.4	364.7	41.0
Wisconsin	432.4	76.7	294.4	61.3
Puerto Rico	36.0			36.0
Total	10,938.0	4,107.5	5,180.6	1,649.9
Grand total	23,311.7	9,353.4	7,866.8	6,091.5

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[1] Class 1.—Forest roads which are on the Federal-aid highway system.

[2] Class 2.—Forest roads which are on the Federal-aid secondary system.

[3] Class 3.—Other forest highways.

[4] The mileages for all of the States have been reclassified in accordance with the classifications established in the revised regulations, effective March 22, 1950, except in Arkansas, Oklahoma, Texas, Virginia, and West Virginia. The mileages shown for Virginia and West Virginia are on the basis of the new classification and are taken from the field recommendations. The revisions of these two systems were not officially approved as of June 30, 1951.

Table 17.—*Status of National forest highway projects as of June 30, 1951, and projects completed during the fiscal year* [1]

State or Territory	Programed,[2] construction not yet authorized			Construction authorized, not started			Under construction			Completed during fiscal year		
	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles
Arizona	$1,245,000	$1,245,000	20.0				$1,651,684	$1,651,684	35.8	$1,030,662	$1,030,662	23.2
Arkansas	143,873	143,873	14.5				369,000	369,000	8.3	283,375	283,375	4.9
California	4,044,298	4,044,298	37.1	$384,200	$384,200	10.9	1,448,000	1,448,000	23.3	1,950,374	1,940,674	60.8
Colorado	2,062,500	2,062,500	55.6	97,500	75,500	1.6	1,124,000	1,124,000	29.8	2,894,800	2,894,800	60.9
Florida	540,000	270,000	15.0				296,138	148,069	18.7			
Georgia	80,206	80,206	14.5				251,776	125,888	8.4	65,532	32,287	5.4
Idaho	3,013,500	3,013,500	54.5	1,205,000	1,205,000	15.3	2,284,000	2,284,000	40.6	1,278,900	1,278,900	32.7
Illinois	139,000	69,500	3.7							50,177	22,414	3.1
Indiana	100,000	42,413	.2				50,586	17,564				
Kentucky	88,000	88,000	1.5									
Louisiana							330,460	165,230	1.8			
Maine	17,179	17,179										
Michigan	566,694	283,347	20.9				276,600	252,050	20.3			
Minnesota	273,727	273,727	11.5							779,922	580,089	35.7
Mississippi				121,900	60,950	10.7				238,887	123,337	10.7
Missouri	105,112	105,112	9.0	154,844	154,844	3.6	122,883	122,883	8.4	48,600	48,600	
Montana	2,600,000	2,600,000	56.9	251,000	251,000	16.2	1,484,000	1,484,000	40.8	1,503,504	1,508,504	62.9
Nebraska	46,406	46,406	10.2				95,930	95,930	.1			
Nevada	264,280	264,280	2.8				526,000	526,000	7.2	63,069	63,069	2.5
New Hampshire				43,600	42,000	.1	342,000	342,000	4.2			
New Mexico	1,254,500	1,254,500	31.0				252,000	252,000	7.7	397,848	397,848	2.0
North Carolina							627,610	313,805	12.8			
Oklahoma	170,000	85,000	3.7									
Oregon	4,305,000	4,230,000	88.4	391,000	151,000	15.2	1,347,000	1,341,945	41.5	6,037,684	5,056,609	113.9
Pennsylvania	240,000	145,000	7.4							207,342	166,342	8.9
South Carolina				105,500	51,400	9.0	157,000	72,074	4.6	148,665	69,209	10.3
South Dakota	260,000	260,000	4.5				331,000	331,000	6.8			
Tennessee	400,000	200,000	11.8				411,658	205,829	6.7			
Texas	62,645	62,645	2.5	209,200	104,600	6.3				118,404	59,200	7.3
Utah	756,000	756,000	36.1	153,000	153,000	10.7	241,000	241,000	11.9	1,239,745	1,239,745	41.7
Vermont	37,293	37,293		42,700	42,700	.5				142,487	71,000	2.7
Virginia	120,000	60,000	4.2	133,156	90,500	7.9	82,455	41,091	6.6	401,012	361,256	9.8

Washington	2, 006, 500	2, 006, 500	48. 3	500	500		1, 076, 000	1, 076, 000	45. 9	851, 863	851, 863	22. 6
West Virginia	200, 000	100, 000	6. 0	27, 340	27, 340		277, 316	138, 658	4. 9	139, 441	139, 441	7. 7
Wisconsin	152, 405	152, 405	11. 0	49, 548	49, 548	1. 2	114, 000	107, 500	10. 3			
Wyoming	1, 110, 000	1, 110, 000	24. 9	250, 000	250, 000	18. 1	383, 000	383, 000	7. 9	2, 247, 430	2, 247, 430	28. 8
Alaska				973, 000	973, 000	8. 6	1, 456, 000	1, 456, 000	12. 4	564, 283	564, 283	9. 0
Total	26, 404, 118	25, 108, 684	607. 7	4, 592, 988	4, 067, 082	135. 9	17, 409, 096	16, 116, 200	427. 7	22, 689, 006	21, 030, 937	567. 5

[1] Includes construction projects only. [2] Initial commitment of funds.

Table 18.—*Mileage of highways in or leading to National Parks, monuments, and parkways constructed by the Bureau of Public Roads, by construction status and by location, as of June 30, 1951*

Park, monument, or parkway (and State)	Total completed as of June 30, 1951	Completed during fiscal year ending June 30, 1951			Under construction as of June 30, 1951
		Total	Initial improvement	Stage construction	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*
Acadia (Maine)	31.3				1.1
Badlands (S. Dak.)	22.0				3.6
Baltimore-Washington (Md.)	6.1				4.7
Bandelier (N. Mex.)					
Big Bend (Tex.)	7.7	7.7	7.7		10.3
Blue Ridge (Va.-N. C.)	347.4	58.2	20.1	38.1	79.8
Bryce Canyon (Utah)	21.7				
Carlsbad Caverns (N. Mex.)	8.4				
Chalmette (La.)	.5				
Chickamauga-Chattanooga (Ga.-Tenn.)	9.4				
Colonial (Va.)	12.2				
Crater Lake (Oreg.)	65.9				
Devils Tower (Wyo.)	.3				
Fort Donelson (Tenn.)	2.8				
Fort Matanzas (Fla.)	.5				
Fort Pulaski (Ga.)	.3				
Fredericksburg-Spotsylvania (Va.)	23.1				
George Washington Birthplace (Va.)	2.6				
George Washington Memorial (Va.-Md.)	14.2	0.9		0.9	
Gettysburg (Pa.)	9.5				
Glacier (Mont.)	73.4				9.9
Grand Canyon (Ariz.)	193.0				
Grand Teton (Wyo.)	6.1				11.3
Great Smoky Mountains (N. C.-Tenn.)	38.5	10.1		10.1	17.8
Guilford Court House (N. C.)	2.6				
Hawaii (T. H.)	35.5				
Hot Springs (Ark.)	3.6				
Kill Devil Hill (N. C.)	1.6				
Lake Mead (Ariz-Nev.)	42.6				
Lassen Volcanic (Calif.)	35.1				30.4
Meriwether Lewis (Tenn.)	1.8				
Mesa Verde (Colo.)	31.9				
Morristown (N. J.)	2.7				
Mount Rainier (Wash.)	90.8				1.0
Natchez Trace (Miss.-Tenn.-N. C.)	129.6	23.1	0.7	22.4	44.5
National Capital Parks (D. C.-Va.-Md.)	5.3	0.1		0.1	3.3
Olympic (Wash.)					6.4
Organ Pipe Cactus (Ariz.)	22.7				
Petersburg (Va.)	8.7	3.4		3.4	0.7
Petrified Forest (Ariz.)	31.1				
Rocky Mountain (Colo.)	54.2				10.8
Scotts Bluff (Nebr.)	1.6				
Sequoia-Kings Canyon (Calif.)	65.4				4.0
Shenandoah (Va.)	96.9	12.4		12.4	15.0
Shiloh (Tenn.)	10.6				
Suitland (Md.)	8.9				
Vicksburg (Miss.)	10.4				
Wind Cave (S. Dak.)	15.9				
Yellowstone (Wyo.-Mont.-Idaho)	315.8				4.0
Yosemite (Calif.)	108.7				
Zion (Utah)	41.6				5.4
Total	2,072.5	115.9	28.5	87.4	264.0

Table 18.—*Mileage of highways in or leading to National Parks, monuments, and parkways constructed by the Bureau of Public Roads, by construction status and by location, as of June 30, 1951*

Park, monument, or parkway (and State)	Total completed as of June 30, 1951	Completed during fiscal year ending June 30, 1951			Under construction as of June 30, 1951
		Total	Initial improvement	Stage construction	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*
Acadia (Maine)	31.3				1.1
Badlands (S. Dak.)	22.0				3.6
Baltimore-Washington (Md.)	6.1				4.7
Bandelier (N. Mex.)					
Big Bend (Tex.)	7.7	7.7	7.7		10.3
Blue Ridge (Va.-N. C.)	347.4	58.2	20.1	38.1	79.8
Bryce Canyon (Utah)	21.7				
Carlsbad Caverns (N. Mex.)	8.4				
Chalmette (La.)	.5				
Chickamauga-Chattanooga (Ga.-Tenn.)	9.4				
Colonial (Va.)	12.2				
Crater Lake (Oreg.)	65.9				
Devils Tower (Wyo.)	.3				
Fort Donelson (Tenn.)	2.8				
Fort Matanzas (Fla.)	.5				
Fort Pulaski (Ga.)	.3				
Fredericksburg-Spotsylvania (Va.)	23.1				
George Washington Birthplace (Va.)	2.6				
George Washington Memorial (Va.-Md.)	14.2	0.9		0.9	
Gettysburg (Pa.)	9.5				
Glacier (Mont.)	73.4				9.9
Grand Canyon (Ariz.)	193.0				
Grand Teton (Wyo.)	6.1				11.3
Great Smoky Mountains (N. C.-Tenn.)	38.5	10.1		10.1	17.8
Guilford Court House (N. C.)	2.6				
Hawaii (T. H.)	35.5				
Hot Springs (Ark.)	3.6				
Kill Devil Hill (N. C.)	1.6				
Lake Mead (Ariz-Nev.)	42.6				
Lassen Volcanic (Calif.)	35.1				30.4
Meriwether Lewis (Tenn.)	1.8				
Mesa Verde (Colo.)	31.9				
Morristown (N. J.)	2.7				
Mount Rainier (Wash.)	90.8				1.0
Natchez Trace (Miss.-Tenn.-N. C.)	129.6	23.1	0.7	22.4	44.5
National Capital Parks (D. C.-Va.-Md.)	5.3	0.1		0.1	3.3
Olympic (Wash.)					6.4
Organ Pipe Cactus (Ariz.)	22.7				
Petersburg (Va.)	8.7	3.4		3.4	0.7
Petrified Forest (Ariz.)	31.1				
Rocky Mountain (Colo.)	54.2				10.8
Scotts Bluff (Nebr.)	1.6				
Sequoia-Kings Canyon (Calif.)	65.4				4.0
Shenandoah (Va.)	96.9	12.4		12.4	15.0
Shiloh (Tenn.)	10.6				
Suitland (Md.)	8.9				
Vicksburg (Miss.)	10.4				
Wind Cave (S. Dak.)	15.9				
Yellowstone (Wyo.-Mont.-Idaho)	315.8				4.0
Yosemite (Calif.)	108.7				
Zion (Utah)	41.6				5.4
Total	2,072.5	115.9	28.5	87.4	264.0

Table 19.—*Mileage of approach roads to National parks and monuments, by construction status and by location, as of June 30, 1951*

Road	Park	Designated	Under construction[1]	Completed[1]
		Miles	*Miles*	*Miles*
Cameron-Desert View	Grand Canyon	28.1		28.1
South Approach	do	52.3		52.3
Jacobs Lake-North Rim	do	31.2		30.9
Mineral-Lassen Volcanic	Lassen Volcanic	8.8		4.7 [2] 4.1
Fresno-Kings Canyon	Sequoia-Kings Canyon	11.2		11.3
Sequoia-Kings Canyon	do	10.4		10.4
Custer-Wind Cave	Wind Cave	8.6		8.6
Southwest Approach	Yellowstone	13.9		13.9
Grand Teton-Yellowstone	do	7.0	4.0	3.0
Red Lodge-Cooke City	do	59.7		59.7
East Approach	do	23.0		22.9
Zion-Bryce Canyon	Zion and Bryce Canyon	31.3	5.4	22.9
Cedar Breaks	Cedar Breaks	2.6		
Total		288.1	9.4	268.7

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[1] These mileages are included in those shown in table 18.
[2] Graded as a forest road project. Figure not included in total.

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